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# The American X-Ray Journal

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*X-Ray Photography*

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*Radio Therapy*

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*Thermo Therapy*

*Hydro Therapy*

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DR. O. SHEPARD BARNUM  
President American Electro-Medical Society.

# THE AMERICAN X-RAY JOURNAL.

Devoted to Practical X-Ray Work and Allied Arts and Sciences.

VOL. XIV.

CHICAGO, JANUARY, 1904.

No. 1

## The Roentgen Ray and Surgery.\*

BY O. SHEPARD BARNUM, M. D.

LOS ANGELES, CAL.

President American Electro-Medical Society; President Southern California Electro-Medical Society; Member Southern California Academy of Sciences; Member American Roentgen Ray Society, Etc.

The operator in electro-therapeutics must today pass between a Scylla and Charybdis—the Scylla of the skeptical and antagonistic surgeon; the Charybdis of the ultra-enthusiastic devotee of the new radio-active powers. A mid-channel course is the only safe one, and this must be the excuse for a short paper favoring a compromise between x-ray operators (among whom I am glad to be numbered) and the surgeons of the old and new schools.

Is the use of the x-ray in any degree a substitute for the knife? This question is now occupying the attention of the leading physicians and surgeons of the country, and rightly so, for its solution means much to suffering humanity. Before expressing a personal opinion, let us look at the question from two or three view-points. Our thots and conclusions will be chiefly based on an extended study and experience in the application of the Roentgen ray in cancerous diseases. Other diseases might well be considered if time permitted, but cancer is a peculiarly surgical field and the ray has been more used for this group of lesions than for any other.

Statistics show a recurrence in 70 per

cent of cases of superficial epithelioma removed by the knife, and 60 per cent fatal termination. In uterine cancers no surgeon can claim better than 25 per cent living patients who have been operated on three years previously, and 7 per cent or 8 per cent living five years after the operation. We venture to say also that a great many of these reported cases were without sufficient verity in diagnosis. Such statistics are discouraging, to say the least, but this hardly justifies the fact that the doctor and layman have jumped too hastily to conclusions as to the efficacy of the x-ray. They have done so, however, for the simple reason that with such statistics as the above in mind, it was but natural to grasp at anything which showed even a modicum of hope of bettering conditions.

State Board of Health reports indicate an increasing number of cancers, and show that at the present time in some parts of this country as many as thirty-five of each 1,000 deaths are from this disease. Is it any wonder that we eagerly reach out for any agent offering the slightest hope of reducing this great mortality? And yet this country has but little over one-half the mortality from cancer that Europe has.

The electro-therapeutist is no longer

\* Read before the American Electro-Medical Society at its first annual meeting, Chicago, Dec. 1-2, 1903.

justified in hiding behind the cloak of the "experimental stage of x-ray work." We know what the ray can do; we know its dangers and its virtues; and tho without explanation as to just why or exactly how the thing happens, the actual results are abundant and justify prognosis. Our technique may be faulty, but our theories certainly are not false.

For the purpose of our argument we may consider the ray under the following three divisions:

1. Stimulating.
2. Inhibitive.
3. Destructive.

In contrast or comparison with surgical procedures the third division is chiefly to be considered. The direct question then arises, Is the destructive action of the ray a fair substitute for the knife in operable cases? I answer, "No." The process of *rayism*—a necrosis of animal tissue—is tedious, varying greatly because of idiosyncrasy of the patient, and the result is sometimes a destruction of too much tissue or an indolent wound which refuses to heal for months or even years. (I am not convinced as to whether this may or may not result in a degenerative cell diathesis.)

Under average conditions and with conscientious regard to the welfare of a patient, what is the proper course of the electro-therapist? In the majority of cases, which from our present surgical knowledge would be classified as operable (with some of the exceptions hereinafter mentioned), I believe the surgeon's aid should be enlisted, for the following reasons:

1. To expedite the work.
2. For the comfort of the patient.
3. To prevent possible septic conditions.
4. To insure against too extensive x-ray necrosis.

Every thinking man will concede the first point. The immediate removal of a tumor by the knife in contrast to either of the necessary processes of Roentgen ray treatment—absorption or ulceration—is most certainly in favor of surgical procedure.

The same reasons hold good for the second point—the comfort of the patient. By the use of the knife we have in most instances to use the ray on a closed wound instead of an open one, thus lessening discomfort, odor, bandages, etc. Patients may by this combined treatment be able to continue employment where otherwise they would be confined to the house. Very few patients will refuse operation when the matter is plainly put before them.

Almost every x-ray operator has seen the process of absorption so stimulated by the application of the ray as to bring in many cases a fatal toxemia. The only alternative to this is a conservatism which may defeat its own ends by discouraging the patient, leading to carelessness and neglect, or reducing its efficiency by tolerance, even to the stage beyond possibility of help by any means.

The fourth point refers to a destruction of tissue beyond what is necessary, or a typical x-ray necrosis in tissue remaining after the diseased portion is fully eliminated—one of those bugbears that the operator dreads beyond words to express. Most radical measures are necessary to heal them, and months pass with so little progress as to try the doctor's patient and patience to the last degree.

In short, I believe that the combination of the two methods is better than either alone. If there exists a suppositious involvement of surrounding tissue and lymph channels, proper drainage can be left in the surgical wound to insure the full effect of the ray following with-



out danger of toxemia. If necessary to preserve the continuity of muscle, nerve or vessel, the knife process can be well curtailed and dependence put on the applications of the ray to immediately follow the operation. In cancer of the breast, for instance, the knife might entirely remove the ulcer and contiguous indurations, leaving a possible involvement of the pectoral muscles, the glands and tissue of the neck, and possibly of the axilla, for the action of the ray.

I have seen many instances where the palliative operation with the knife to remove danger of infection would have been very desirable if the ray could have been applied immediately after, and tho in these instances no permanent cure could be expected, the result would have been a prolonging of life and materially smoothing the rough road to the final end.

In my experience I have seen no ill-effects from the use of the ray before a surgical operation, altho I have considered and studied the possibility of such very closely. I am convinced that in malignant conditions the ray should invariably follow the knife as a prophylactic measure, nor should it be delayed until a recurrence is manifest; and I do not hesitate to use it conservatively prior to operation.

I do not want to be understood, or rather misunderstood, as saying that there are no cases for the ray alone—far from it. The question of securing the aid of a surgeon revolves about the question of degree in progress of the lesion, its position, character and status from a surgical view-point. A summary of my thot would perhaps be that the ray should be used:

1. In all inoperable cases.
2. In all purely superficial lesions, either to follow the knife or alone.

3. In all cases where there exists a doubt of malignancy. This for its inhibitive power and value as a means of promoting absorption.

4. Always to follow operations for malignant conditions.

5. Alone in primary lesions of small extent and superficial.

6. In all recurrent malignant growths.

7. As a palliative measure in all cases with a fatal prognosis.

All honor to the great discovery of Roentgen and its advance into physiological therapeutics, but let us curb our natural enthusiasm, or at least make it subservient to a true spirit of scientific search for demonstrable facts, taking from each new advance in knowledge what is compatible with accepted truths, and thus making our mixture the better for the new ingredient.

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#### Protection Against the X-Rays.—

The danger to which an operator is exposed by employing his own hand or arm as a test object in gauging the quality of his tubes has led to the production of numerous protective devices. None of these has fully met all indications. Carl Beck (*Berl. klin. Woch.*, Aug. 10, 1903) publishes an ingenious suggestion, which consists in the substitution of a prepared skeleton of the arm for that of the operator. These bones, properly mounted, may be attached to a piece of pasteboard or other material transparent for the x-ray. The shadows of the bones, just as in the living member, are black when soft tubes are used, and light gray when the harder tubes are employed. This test object may be readily manipulated by the operator, without the latter coming within the radius of action of the rays.—*Med. News.*

# Electro Therapy.

A Course of Twenty-four Lessons under the auspices of the Chicago College of X-Ray and Electro Therapeutics.

## LESSON 8. THE STATIC MACHINE.

When two non-conductors are rubbed together and immediately separated, both surfaces are found to be electrified, one positively, the other negatively. The surfaces are also said to be "charged." The sum of the two charges, however produced, is always zero.

An insulated metal ball connected with the positive pole of a battery becomes positively charged. If another conductor is made to touch the charged ball, a positive current passes from the ball to it, and the second conductor, if insulated, receives a part of the charge. A charge passes easily, without contact, to or from a metallic point. By means of one or more metallic points a charge may be distributed from a conductor to a non-conducting surface, such as glass or mica, or collected from such a surface and concentrated upon a metallic ball.

An electric charge is a strain of some kind involving the atoms and the adjacent ether. According to the vortex theory this strain is a simple twist, such as is produced in a piece of rubber or other elastic substance when one end of it is held firmly and the other end rotated. A positive current, being a right-handed rotation, makes a right-handed twist, which, when the twisting force (electromotive force) is removed, makes a positive current from that surface. Similarly, a negative charge is a left-handed twist, produced by a negative force and giving rise to a negative current.

Though an electric current is always both positive and negative, a charge is either positive or negative, but can not be both. A little reflection will make it clear that the twist in a positive charge is like that in a left-handed screw, and the twist in

a negative charge is like that of a right-handed screw. The sum of equal amounts of the two twists (charges) is necessarily zero.

The potential of a charge is the electromotive force required to produce it or to balance it so that there shall be no current either way in a conductor in contact with it. Every part of a conductor (in which there is no current) has the same potential, but the potential decreases as we recede from the charged surface. The electromotive force in any given part of an electric circuit is the difference of the potential of the two ends of the part.

A static machine is a device for producing currents of very high electromotive force. Incidentally, there are produced at the same time charges of equally high potential. The charges are in themselves of no therapeutic value whatever. The currents are very valuable.

The various types of static machines and their modes of action are fully described in nearly all text books of electricity, and are only mentioned here. The friction machine consists of a glass plate or disk mounted so as to be rotated by a handle. The charges are made by the friction of an amalgam rubber, which presses against the plate. The positive charge is collected from the plate upon a large rounded metallic conductor. The machine is of little use therapeutically.

The Holtz machine acts by induction only. It is very efficient, but must be charged each time to start it. In all induction machines one-half of the revolving plate carries positive charges at the same time that the other half is carrying negative charges, doubling the current capacity of the machine.

The Toepler-Holtz machine is a modification which makes the machine self-starting.

The Wimshurst machine is self-starting, acts by induction and is efficient. It has two disks, which rotate in opposite directions. It is used much more widely in Europe than in America.

The value of a static machine depends much more upon the details of its construction than upon the type selected. It goes without saying that the mechanical construction must be first-class in every particular. A very fair-looking machine may be made which will give excellent service for a few weeks, but in a short time the metallic parts become rusted, the brushes and combs displaced, the bearings run hard, the glass disks get loose or strike each other, the case no longer fits so as to be airtight, and the whole machine has a decrepit appearance. Points of this kind are best guarded by purchasing a machine from known and reliable makers, under a guarantee of such construction as will avoid such premature old age. A well-built static machine, with reasonable care, should keep in good order for five years at least. The small metallic brushes will wear out in a few months if the machine is used much, and must be replaced by new ones. Some oil or vaselin (petrolatum) must be applied to the bearings several times a year. Dust will collect on the inside of the case as well as on the outside, and must be wiped off. The shellac on the glass plates, if of a poor or medium quality, may need occasional renewal. Lastly, but not by any means least, the interior of the machine must be kept dry.

Some makers claim that by the use of materials of a superior quality their machines will work well without any special drying apparatus. However this may be, there is no doubt that any static machine

will do better work when dry than when damp; and a great many machines will not work at all unless kept reasonably dry inside. There are several ways of keeping a machine dry, and here also it is more important that one of the plans should be well executed than that any particular plan should be selected.

For a temporary dryer nothing excels a freezing mixture. A covered tin can is filled with a mixture of crushed ice and salt (ice two-thirds, salt one-third). This is wiped dry, placed inside the case of the machine, and the case closed. In from ten to thirty minutes the greater portion of the water vapor in the case has been frozen on the outside of the tin, and the machine is ready for business. The tin must be removed before the ice on the outside of it begins to melt. The larger the tin the quicker and more certain the result. Not less than two liters of the mixture should be used. This plan is good for an emergency, or when no other good drying material is at hand; but it is not satisfactory for regular use.

A simple and cheap permanent dryer is made by enclosing twenty to fifty pounds of freshly-burnt quicklime, in an airtight box, which is in communication with the interior of the machine. The lime must be replaced by a fresh supply as often as it becomes slacked. If there is room it may be placed in an open box on the inside of the case.

Another plan which is very satisfactory is to place one or two pounds of pure calcium chlorid in an open dish of glass or porcelain. The chlorid must be fused, not crystallized. It is efficient until it has absorbed so much water that it is completely dissolved in it. If the water is then driven off by heat the calcium chlorid is as good as new.

Another plan is to place in an open and deep glass vessel two or three pounds



of strong sulfuric acid. This absorbs water quite strongly until its volume is increased by one-half. It must then be replaced by a fresh portion.

Instead of sulfuric acid caustic potash may be used, and like the calcium chlorid it is efficient as long as any of it remains undissolved.

If cheap and impure chemicals are used gases are liable to be given off which may corrode the metallic parts of the machine or soften the shellac on the plates. It is particularly necessary to call attention to the danger of using "chlorid of lime" instead of calcium chlorid. Sometimes drug clerks imagine the two to be identical.

The material of which the plates are composed is of little consequence from an electrical standpoint, so long as they are good insulators. Glass, mica, vulcanite, gutta-percha are from this standpoint equally satisfactory. The durability of the plates and their original cost are the items for consideration. A well-balanced glass plate can be run at a speed of five or six hundred revolutions a minute. The ordinary glass plate will not safely go beyond three hundred. A mica or vulcanite plate is much more expensive, but can be run at a speed of nearly two thousand.

The electro-motive force of a static machine depends upon the diameter of the plates and the degree of insulation of its various parts. In ordinary machines the electro-motive force varies from half a million to a million or more volts. The electro-motive force required to make a spark across one inch of air varies much under different conditions. It has been estimated as low as twenty-five thousand volts and as high as one hundred thousand. The latter number is the nearer correct.

The current delivered by a static machine depends in part upon the resistance of the circuit, in accordance with Ohm's law; but the maximum current delivered by a machine is limited by the amount of surface of the revolving plates which passes the toothed combs in a second, as well as by the intensity of the charge upon the plate. Other things being equal, a machine with eight revolving plates will give twice the current that can be obtained from a machine with four revolving plates. But if the four plates are run at twice the speed of the others the current produced by the two machines will be nearly equal.

Two static machines may be connected together in the same way as two cells of a battery, and the same laws of current and potential apply. If the similar poles of two equal machines are connected together the resulting current has the same electro-motive force as before, but its amperage is doubled. If the machines are connected in series, that is to say, the positive pole of one machine with the negative pole of the other, so that the electro-motive forces of the two are acting in the same direction in one circuit, the electro-motive force of the resulting current is twice as great as before.

A machine having sixteen plates (eight revolving) or less can be operated by hand if necessary. Larger machines must have some mechanical motive power. Water power, if available, is very satisfactory. Gasoline or steam engines are frequently used. Electric motors, both for direct and for alternating currents, are much more convenient than engines, and are not liable to get out of order.

## Dangers to the X-Ray Operator.\*

BY JOHN T. PITKIN, M. D.

BUFFALO, N. Y.

When for the first time one beholds an x-ray tube in operation, the mild green or yellowish color of its active hemisphere, the blood red or orange color of the inactive hemisphere which can be obtained with strong condenser discharges, the ruby redness of the target, or the light blue color of the kathode stream, a blue cloud hovering behind the target, the green circular aurora borealis or green scintillating radial aurora australis, the bright green dancing spots of the kathode splash, the circular green zone of the tube reversed, the bluish twinkle of its fading light, the slower dying out of the incandescence of the target and the target's own modicum of ordinary light, the ever-changing, ever-expanding circle of colors on the kathode cup, the bluish marking of the tube which has seen much service, and perchance the pyrotechnical display of the punctured tube, he is liable to exclaim, How beautiful!

As he observes the delineation of bones, viscera, or foreign bodies upon the fluorescent screen or photographic plate, its curative power in skin affections, painful disorders, cancerous, tubercular and other malignant diseases, he will in all probability say, How marvelous!

Should he strive to fathom its physics, its modus operandi, he asks himself of what form of matter the kathode and the anode streams consist; whether in the working of the tube there is transmutation of matter from one elementary form into others, or of matter into energy. All the colors of the rainbow are de-

picted on the concavity of the kathode cup. How are they formed? From whence came they? Of what composed?

Are there separate and distinct rays emitted from the tube, some of which cause burning, other fluorescence, and still others photographic effects; or do the same rays produce all of these phenomena? What rays possess the healing power?

*Where and how does the x-ray have its birth? Of what does it actually consist?*

(1) In the old form of Crookes tube, without a target, the x-light is generated in the glass wall of the tube wherever it is subjected to bombardment, and at the place of bombardment heat and a green fluorescence always accompanies the generation of the x-light; and in the form of tube now employed the portion of the kathode stream passes by the target; or if the target is displaced the entire stream passes by and generates x-light likewise by the bombardment of the glass wall of the positive end of the tube, accompanied by the green fluorescence (which on account of its position and shape I have christened the aurora borealis of the x-ray tube) and the usual modicum of heat; then does it not follow that wherever there is a green fluorescence of the glass wall of the tube, with the production of heat, there the x-rays are always generated, and the glass surface is the seat of molecular bombardment?

(2) If the rays of Roentgen have their birth at the target, why do they not shine thru that structure as they do thru the glass wall that is subjected to bombardment? Can the target reflect rays that

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\*Read in part verbatim, in part by outline, at the meeting of The American Roentgen Ray Society, held at the University of Pennsylvania, Dec. 9-10, 1903.

are not reflectable, and not subject to refraction or diffraction?

(3) Why are the afferent target rays convergent, the efferent target rays divergent (leaving out of consideration the effects of their respective construction), unless the former partake of the character of the negative, the latter of the positive, electrical brush discharge?

(4) If there is not an anodal stream, how shall we account for the bluish marking of the glass wall of the active hemisphere, which is proportionate to the amount of service a given tube has seen?

(5) If the x-light is not generated in the glass wall, why does its volume increase with the size of the tube employed, and consequently with the extent of the glass surface exposed to the anodal influence, while the size of the target is relatively unimportant?

(6) If the x-light is generated both at the target and in the glass wall, would not the photographic plate show a double picture?

(7) If it is the x-ray that causes the glass wall of the tube to fluoresce with a green color, why does it not cause the same phenomenon in a piece of glass held in any portion of the x-ray field?

*Are infinitesimal particles of glass or other forms of matter projected from the tube into the x-ray field?* (Nicola Tesla was one of the first to advance the hypothesis that matter was thrown from the tube outward into space.) If not, why is the x-ray inflammation of the skin nearly always upon the side of the parts presented toward the apparatus? Why does the clothing or a thin aluminum screen afford so much protection to the bodies of operators and patients? The dermatitis may end abruptly where the clothing has covered the person.

Is there some unknown radio-active element like radium, polonium, thorium,

uranium and helium in the glass wall of the tube, a hypothetical roentgenium, if you please, which, when subjected to bombardment, emits radiant energy or radiant matter?

(1) If this is not the case, why should a new tube fluoresce with a bright grass-green color, become duller, more like an olive green, then yellowish and paler with months and years of use?

(2) Or why should the radio-activity of an adjustable vacuum tube gradually decrease after a year or more of service, altho the target glows with the usual amount of redness?

(3) How shall we account for the bluish, greenish and yellowish tints (not pyro stains) sometimes seen in the developed negatives?

(4) Why does the new examining screen follow somewhat the same change of colors as the x-ray tube?

(5) Will the incorporation of radio-active elements in the glass wall of the tube multiply its present capacity and its therapeutic effects? If so, what a promising vista of future possibilities opens before the radiographer.

(6) Why should an eight-inch tube exhausted by use recover by rest much more rapidly than a smaller tube?

*If he injudiciously ventures too near the excited tube, or remains in the*

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[\*Additional notes taken at the Philadelphia meeting of the Roentgen Ray Society. Dr. James P. Marsh, of Troy, N. Y., reported that the soles of his feet had been burned. Their position was under the operating table, the Doctor sitting near the patient. As a result of the condition of his feet the Doctor was obliged to be carried about by attendants. It was explained at this meeting that the dermatitis probably came from the reflected rays.]



weaker zones of the field, too many days, months, perhaps years, and if in consequence he sustains x-ray inflammatory effects, with their complications and sequelæ, he is liable to ejaculate, How infernal! for beautiful, marvelous, profound and infernal are the attributes of the x-ray tube.

It is with the last subdivision, the untoward effect of the x-ray upon the operator, with which the present paper is principally concerned.

#### X-RAY INFLAMMATION.

This danger to the operator increases with:

- (1) Nearness to the tube (in a compound multiple ratio).
- (2) Number, frequency and duration of exposures.
- (3) Size, hardness and degree of excitement of tube.
- (4) Poor bodily condition.
- (5) An injury, blow or cut on parts slightly affected.
- (6) Number of previous attacks, each attack leaving him more vulnerable.

Conversely, the danger decreases with:

- (1) Distance from tube.
- (2) Infrequent and short exposures.
- (3) Softness of tube, provided it is under-excited.
- (4) Interposition of substances, clothing, screens of copper plate, iron, tin, zinc, aluminum, plate glass, etc., their density, thickness and other qualities as yet unknown.
- (5) Vigorous bodily condition.
- (6) A position behind the target and static machine, from whence rheostat and spark gaps can be operated.

*The danger varies with the different types of tubes*, and we may judge by the appearance of a tube the degree of penetration of its rays without the employment of the fluoroscope.

All other conditions being equal, a hard tube is one in which the free concave surface of the kathode cup has a light blue, transparent, circular spot, about the size of a silver dime, with a prismatic ring of colors at the outer border of the blue. The target glows with a redness thruout its entire extent with a reddish white center. The glass wall of the active hemisphere, covered with a translucent blue deposit, is the most dangerous; its rays are most penetrating.

A medium tube, one having a kathode cup colored with a dark blue central spot about the size of a five-cent silver piece, and having a target that glows with uniform redness, a blue cloud hovering behind the target, is less dangerous; its rays are less penetrating.

A low tube, one having a kathode cup colored seal brown, of a golden hue, or a minute, blue-black central spot with a red border to the blue, having a blue kathode stream and a green aurora borealis, i. e., positive or northern green circles at the positive end, the stem of the same extremity having a green color, is less dangerous, its rays being least penetrating.

The classification of tubes into hard, medium and soft, is very general, because in practice we are using tubes of every degree of each subdivision; but it will answer our present purpose if I make special mention of the extremely high and extremely dangerous tubes that are hard to excite; once started they light up irregularly accompanied with a crackling sound, they have small dancing green spots, formed by the splashing of a portion of the kathode stream against the wall, they also have a green aurora australis.

(To Be Continued.)

## X-Ray Burns.\*

BY ROBERT S. GREGG, M. D., CHICAGO.

It is well known that the x-rays produce what is known to the laity as a burn, but technically is a pure and simple dermatitis. This effect I attribute to its chemical properties. Time must elapse, from a few hours to a few days, before the characteristic symptoms arise. The reaction in some individuals arises much quicker than in others. It may be noted that after the patient has had this condition, and upon healing of the same, pigmentation is induced, probably due to the greater blood supply and extravasation in the parts, and it has been my observation that a patient will not reburn as readily with the same amount of treatment as he did at first, due probably to the extra resistance of the skin from the pigmentation caused by the chemical properties of the x-ray, which may be termed partial immunity. If the treatment be excessive, decomposition takes place beyond the power of the tissue to re-establish an equilibrium; in other words, the anabolic process of the tissue does not meet the katabolic process which has been accelerated by x-rays, and a consequent destruction takes place. The sloughing condition at times noticed is due to a high degree of katabolism. How are we to prevent or overcome this condition? First, a proper knowledge of the action of the tube is essential. Second, we should endeavor to know the susceptibility of each and every case. Here a knowledge as to the constitutional condition of the patient is a great aid. A lessened vitality on part of the tissues and the body as a whole predisposes to a much quicker decomposition, with a lessened reaction to the same. Idiosyncrasies are not to

be considered. Healthy tissue resists the action much more strongly and longer than diseased, owing to its greater anabolic or assimilative power. On this account it is perfectly safe for the x-ray worker to expose healthy tissue in the adjacent area, knowing that he first observes reaction in the diseased area, and with close watching can stop short of destruction of healthy tissue. The factors that enter into the production of an x-ray burn are as follows: Actinic or chemical rays, katabolism, anabolism, resistance, vitality, susceptibility and pigmentation.

I think it might be well here to speak of the results produced by different light treatments as a whole, and draw therefrom some comparisons as regards the cause of their efficiency and destructiveness. I think we will find that heat is the factor paramount as regards the results produced in certain forms of light treatment, and the actinic properties the therapeutic and destructive agent in other forms, namely in the x-ray. We know that if light is concentrated a greater production of heat accrues, which is due to concentration and the resistance of the medium. The beneficial effects constitutionally are co-existent with the amount of sweat produced, which is the desired aim where heat is the paramount factor. The flushing of the capillaries of the skin with blood, and maintaining the same for a time, depletes deep congestion. We are aware that a red medium will absorb everything but the heat rays, a blue medium everything but actinic rays. The sun produces what is known as a sun burn, but technically is an erythema in the true sense. It is not a burn, because it occurs several hours after exposure and produces a pigmentation.

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\*Read at the first annual meeting of the American Electro-Medical Society, at Chicago, Dec. 1-2, 1903.

tion of skin similar to that of the x-rays, so that it must be due to the chemie or actinic rays. This erythema, whether from sun or x-rays, is followed by pigmentation, which offers great resistance to actinic rays, so that exposure over the same area has to be increased in order to produce the same results. Chemie rays are a powerful stimulant to metabolic processes. We find in the negro a person unsusceptible to the chemie rays of the sun; in other words, an erythema (sun burn, so-called) does not take place, due to the large amount of pigment already in the skin. We also note that while, as above stated metabolic processes are remarkably increased, it does not appear to affect the red blood corpuscles any more than probably to cause them to absorb the chemie or actinic rays, and in turn give them off again. On the white corpuscles it seems to produce a leucocytosis, which we know is nature's bulwark for defense against disease. It has been demonstrated that silver chlorid injected under the skin will turn black when subjected to chemie rays, proving conclusively their activity within the tissues.

The treatment for a burn is first and foremost to omit intense raying, then increase visceral elimination and treat locally; in fact, meet the conditions as they arise. Some experts report much more rapid recovery under very mild raying than when raying is omitted. Absorption is taking place so that elimination is absolutely necessary. An x-ray burn requires a long time to heal, as a rule, due

to the lessened vitality of the tissue cells, so that the patient must be built up constitutionally. Visceral drainage is paramount as an adjunct to treatment by x-rays; and all patients, no matter what the condition, must be drained. Half normal salt solution is to be given, a glassful every two hours, for six doses daily, to act on the bowels and kidneys. Associated with this a mild laxative sufficient to produce a daily stool is probably the best method.

Much has been said regarding the necessity or advisability of producing a dermatitis or x-ray burn in order to aid a cure. I hardly think it advisable, especially in an ulcerated area, because a very rapid metastasis invades the adjacent inflamed area, particularly when the burn is very severe. Hence the disease spreads, and instead of being cured the patient's condition is worse, and he usually dies of sepsis. Not only is this true of metastasis, following an extreme dermatitis of an ulcerating area, but in conditions of cancer, which retrogrades under certain modes or technic of treatment; and particularly when ulcerating areas are exposed to the x-rays without properly protecting the parts against dust particles which are thrown off from the surface of the tube. This is often the cause of secondary infection. While under treatment of x-rays it is essential that the parts be properly protected by borated gauze, or some other antiseptic protective agent.





# Galvanic Electrolysis as a Cure for Stricture of the Urethra.\*

BY J. C. LUKE, M. D., OCILLA, GA.

In the treatment of urethral stricture we have in the galvanic battery a safe and certain cure, if properly used. It is a well known fact that at the positive pole of a galvanic battery we have an acid reaction and if applied to a mucous membrane it has a contractile action. At the negative pole we have an alkaline reaction, and if applied to the mucous membrane we have a dilating effect: So in treating stricture we should never use the positive pole, but always the negative, in the urethra. My plan is the same as was used by the lamented Dr. Robert Newman, only I possibly make the treatment a little more frequent than he did. He gave a treatment about once every week or ten days. If I have a very severe case I treat my patient from every other day to every fourth day, and get the same results in a good deal less time.

My plan is simply to watch my patient closely and if I set up sufficient irritation to cause him much pain on micturition I leave off all treatment until he is in good shape again. I then continue my treatments as before until I get the urethra so that I can pass the proper-sized sound. I here cease to use galvanism, teach him how to pass the sound, and leave him a sound with instructions to pass it at least once a week for five or six months. So far I have had no trouble in the cure of urethral stricture.

The current used in treating stricture should never exceed 10 milliamperes, and from 3 to 6 is what I would deem safe, as with that current you seldom set up sufficient irritation to cause any trouble or even stop the patient from work. The following case will show the results in my hands:

CASE No. 3. W. B., white man, age 38 years, railroad engineer; 16 years ago had gonorrhea, which was treated and cured by his physician with the usual astringent injections, after which he married and has raised a family of five children. Some three years ago he noticed he was troubled some with his bladder, and after passing water there would be a dribbling. This trouble kept growing gradually worse until he consulted his family physician, who told him that he had some slight bladder trouble, prescribed for him and gave him some relief. But he noticed that the stream was small and sometimes hard to start, and his condition gradually grew worse until he got to where he "wet on his feet," and he then consulted me in June of this year. I put him on my table and tried to pass a No. 10 sound, but without success. I then took small filiform and with difficulty succeeded in passing it thru into the bladder. I then passed a No. 10 copper electrode down to the stricture and turned on a current of six milliamperes for three minutes (I had the positive electrode placed on abdomen, with negative to urethral sound), but failed to pass it. I had him then go home, with instructions to come back on the second day. He was on hand promptly and I used the same sound to start with, and with the same current in about one minute's time I had passed thru the first stricture, which was about two and a half inches from the meatus. I found, on passing the electrode on down, that about one inch from the first there was a second stricture thru which the electrode passed in about two minutes, after which I could pass it on to the prostate gland. At this treatment I kept passing different

\* Read before the American Electro-Medical Society at its First Annual Meeting at Chicago, Dec. 1, 2, 1903.

electrodes until I could pass size 16. I then stopped and told him to come to the office on the third day. But that evening he had a severe chill and high fever which was overcome by large doses of quinine. He called at my office on the fourth day. I began with electrode size 14 and passed them with the negative current six milliamperes until I reached size 20. I gave him quinine after his treatment so as to keep off a chill, and had him call again on the third day, which he did. I then passed from size 20 up to 24, and the third day from then passed up to size 28, and then put him to using steel sounds. Up to this time he has had no trouble. He noticed from the first treatment that he could

pass his urine more freely, and now passes it like he did when a boy, he says. He never had any trouble at all from the treatments, except the one urethral chill, and he says that now he is perfectly well, so far as he can tell.

I have a number of cases that I have cured in like manner, but this case will illustrate the plan of treatment, and I feel safe in saying that any case of organic urethral stricture can be cured if this plan is properly carried out.

It is best never to use any force in trying to pass the electrode thru the stricture, as the action of the current will dilate it sufficiently, and there is no danger of setting up any severe irritation if no force is used.

## Electro Physics.

### New Source of X-Rays.

The editor of the *Medical Herald* for November thus relieves his mind regarding radium:

"The discovery of the rays as well as the means used for its production assume a very different plane, however, when we consider the substance radium, the work of the Master Builder, a substance so perfect in its construction, so complete in its action and so wonderful in its working as to make us feel that our most finished machinery is crudeness itself, and our work of the most bungling character when compared with the work of Him who spake to the light and it was."

### The Electrophone.

According to *Electricity*, the electrophone is rapidly coming into favor among reporters. The reporter by this means may do his work in a distant office, away from the disturbances of a public audience, where every word is heard distinctly over the wire.

### Heating Effects of Radium Emanation.

To settle the question whether the heat emitted by radium is directly connected with the radioactivity of that element, or independent of it, Messrs. E. Rutherford and H. T. Bates have carried out the following experiments. The heating effects of thirty milligrams of pure radium bromid was first measured in a differential calorimeter. The radium bromid was then heated to a sufficient temperature to drive off the emanation, which was condensed by passing through a short glass tube immersed in liquid air, and then the tubes were sealed off. In testing the de-emanated radium, the heating effect diminished rapidly during the first few hours; fell to a minimum corresponding to about 30 per cent of the original value, and then slowly increased again. On substituting the emanation tube in the calorimeter, the heating effect first increased for a few hours to a maximum corresponding to about 70 per cent of the original heat emanation of the radium, and



then slowly decayed with time. At any time after removal of the emanation, the sum of the heating effect of the de-emanated radium and of the emanation was found to be the same as that of the original radium. There is an exact parallel between the variation in radiating power, measured by the  $\alpha$  rays, and the heating effect. It is thus seen that the heating effect of radium directly accompanies the  $\alpha$  radiation from it, and is always proportional to it; and that more than two-thirds of the heating effect is not due to the radium at all, but to the radioactive emanation which it produces from itself. This result accounts for the variation of heat emission with age, observed by the Curies. The amount of emanation from thirty milligrams of radium bromid was sufficient to cause a bright phosphorescence in the tube, but it was too small either to measure or to weigh. The amount of heat emitted from the radium emanation is thus enormous, compared with the amount of matter involved. The results are explained on the disintegration hypothesis, in which the heat is considered to be derived from the internal energy of the atom. If, however, as held by some, radium gains its heat from an external source, it would be necessary to suppose that less than one-third of the heat is due to the radium itself, and that the other two-thirds are due to the radium emanation which is being continually produced, and the power of which of absorbing from an external source decays with time.—*Abstracted from Nature (London), by El. Review.*

#### Electricity in Dental Extraction.

From a paper read before an eastern dental society we note that the writer states that electricity is taking the place of gas and ether rapidly in dental extractions. The current, he quotes, is

that of high frequency and is applied to the lower jaw, where the operator desires to render it insensible by means of a heat apparatus. The patient, it is claimed, feels nothing more than a slight heating of the affected parts. In our opinion, this method is much safer than cocaine and other anesthetics, that are so largely used by the profession.—*Medical Educator.*

#### Röntgen Ray Tanning.

It is stated from Cincinnati that experimenting has resulted in the discovery of a process of tanning, by means of which hides can be transformed into leather in a short time by the use of the x-ray. The hides will be soaked in lime for the separation of the fibers and removal of the hair, as is done now. When this has been completed, which usually requires about four days, the hides will be soaked in a solution of certain chemicals, a part of the invention, for about two hours, and will then be exposed to the x-rays for about fifteen or twenty minutes, which will thoroly tan them. The finishing will then proceed in the way employed at present. Under the new system the chemicals absorbed by the hides during the two hours soaking are said to be decomposed by the x-ray in less than half an hour. After the hides have been soaked in the solution they are put on a highly polished steel plate and a series of three tubes diffuse the rays upon their entire surface. They remain in this state for about twenty minutes, when they are ready to finish as usual into enamel, patent leather or any desired article. The great difficulty which the inventors met was to obtain a ray sufficiently strong to penetrate the entire hide. Now, twenty hides, one on top of the other, can be "rayed" at once. The inventor asserts that not only will this new process reduce the time necessary for

tanning from four months to four days, but it will also reduce the cost of manufacture fully 75 per cent. As if this advantage were not sufficient, it is added that the costs of fitting up a plant necessary for the working of the process is only one-fourth the cost of erecting a plant under the present system.

#### Power of Radium.

Mr. Edward D. Adams, of New York, has presented to the New York Natural History Museum a tube of radium of 300,000 power. This was secured thru Dr. George F. Kunz, the gem expert of Tiffany's where, as well as at the Museum, some most interesting experiments have been made on precious stones and crystals, including the new Kunzite. Working in experiments together, Dr. Kunz and Dr. Charles Baskerville, of the University of North Carolina, believe they have made a valuable discovery in connection with willemite. By mixing radium with natural willemite, pulverized to a powder, the activity or power of the former

substance is multiplied a hundred-fold, and probably—for no instrument has been devised for measuring the increase of the activity—a thousandfold. That, at least, is the temporary effect of the mixing of the two substances. Time must tell whether one will nullify the other. Willemite is a comparatively cheap silicate of zinc. It is possible, also, that there is in willemite a substance which is as yet unrecognized as a distinct element, but which produces the radioactivity that has awakened the enthusiasm of the two experimenters. But thus far it is taken for granted that the one substance merely stimulates the activity of the other. The germ of a very valuable discovery seems to lie here. Mr. Adams has now supplemented his previous generosity by authorizing Dr. Kunz to secure some radium of not less than 1,800,000 activity, which will probably be placed at the disposal of some of the hospital authorities for experiments on the alleviation or cure of disease.—*El. World and Eng.*

## Radio Therapy.

#### Cancer Cured by Radium.

At a recent meeting of the Vienna Academy of Medicine Professor Gussenbauer read a paper giving details of a case of cancer of the hard palate which was cured by means of radium rays. The patient, a man past sixty years of age, had been repeatedly operated on without success, the disease recurring and rendering necessary further and more extensive operations each time. After the last operation, which occurred last fall, it was decided that nothing further should be undertaken. At this time the individual was exposed to the radium rays, and a gradual and complete disappearance of the growth took place which up to the

present time has not returned.—*Medical Age.*

#### What Can Be Done For Cancer?

Dr. Emory Lamphear (*Amer. Jour. Surg. and Gyn.*, November) says cancer is a purely local disease at its beginning and all cancers may be cured by early incision. England with her thirty-five millions has an annual loss of 30,000 lives from cancer. Various methods of treatment are discussed briefly, namely:

1. Excision by a cutting operation (knife or curet).
2. Removal by actual cautery.
3. Destruction by pastes (arsenical, etc.).

4. Endermatic introduction of destructive fluids into or around the morbid growth.

5. Use of x-ray.

6. Finsen light.

7. Solar cautery.

"Each of these has its advantages and disadvantages under certain conditions; each, perhaps a special adaptability to peculiar circumstances. Common sense as well as surgical judgment must be exercised in the selection of the particular kind to be employed in each individual case."

Special directions are given for the treatment of cancer of the face, tongue, larynx, breast, rectum, uterus, etc.

#### Cancer Following X-ray Burns.

Apropos of the reports from America of the injuries to Mr. Edison and assistant in the use of the x-rays, we are again reminded of the unfortunate death of Mr. Blacker, whose widow has just been granted a pension of £120 by the British government. This is a tardy recognition of Dr. Blacker's treatment of the king for rodent ulcer. His majesty recovered, but Dr. Blacker died, not, perhaps, from the direct effect of the rays employed in treating the royal extremities, but, rather to his devotion in treating a large number of cases connected with the hospital. There are now a considerable number of cases on record of cancer developing at the site of x-ray burns. It is curious that the most of these cases were epithelial growths, the kind of cancer in which the x-rays are especially valuable.—*Medicine*.

**X-Ray and Light Research.**—At the last session of the legislature \$25,000 was appropriated to the University of Pennsylvania for a laboratory for x-ray research and for Finsen light apparatus. The department will be connected with

the University Hospital. It is planned to build a laboratory in connection with the Agnew pavilion. Dr. Henry K. Pancoast, assistant instructor in clinical surgery, and assistant demonstrator of surgery, will have charge of the department. It is the purpose to establish a very complete Finsen light plant, with the prospect of undertaking the first extensive experiments conducted in this country by this method in the treatment of diseases of the skin.—*Jour. A. M. A.*

**Radiotherapy in the Treatment of Ozena.**—Adolphe Casassa says that four species of bacilli have been described as specific to ozena, but so far treatment by antiseptics and by serum therapy has proved valueless. Professor Dionisio has reported the result obtained in six cases by the use of the x-ray. There was rapid diminution in the secretion and crusts, and prompt disappearance of the characteristic odor, even in cases that had proved rebellious to all other treatment. More recent reports have brought the number of cases improved up to twenty. The author in his own experiments obtained such excellent results that he can only conclude that radiotherapy is the first and only rational treatment for this offensive and troublesome disease.—*Revue Internationale de Thérapie Physique*, October 1, 1903.

#### Legal Status of the X-Ray.

Hon. W. W. Goodrich at the meeting of the Medical Association of New York State delivered an address upon this subject. Decisions of the supreme court of Colorado and Tennessee place x-ray photographs upon the same basis as ordinary photographs of the surface. The photographs must be verified by an expert of known qualifications. With regard to x-ray burns the same rule holds as in



other cases. The physician is bound to treat his patient with the same skill as is usual in the time and place where the treatment takes place.

#### Radio-Therapy.

Dr. C. D. Center, Quincy, Ill. (*Int. Journal of Surgery*, October, 1903), reports a number of cases treated by x-rays in his practice, including lupus, epithelioma, carcinoma, sarcoma, psoriasis, eczema, hypertrichosis, syeosis, nevus, lichen planus, pruritus, keratosis, acne and ke-loid, with varied success. In one case of hypertrichosis the hair recurred more luxuriantly than before. Two cases of ke-loid were practically cured. In several cases of carcinoma autointoxication developed and a fatal termination was probably hastened by the treatment.

#### X-Ray, Light and High Frequency Currents.

Dr. B. H. Boggs, New York City, at a meeting of the Medical Society of Pennsylvania, September 23, 1903, said that the x-ray does not cause metastases in carcinoma but rather prevents them. Of twenty-eight cases of pulmonary tuberculosis, two were apparently cured. Of five cases of tubercular growths three were cured; of twenty cases of lupus all but two (which were probably syphilitic) responded to x-rays. Caution is necessary in

deep tumors lest a septic condition may be caused by absorption of broken down material.

#### Future of the Roentgen Rays.

In *The American Practitioner and News* (October, 1903) Dr. Waltham has an editorial on this subject. He considers the x-rays to be of real value only in diseases that are comparatively superficial, and that we can expect little improvement in such deep seated diseases as cancer of the stomach. The most suitable cases for x-ray treatment are epithelioma of the skin, enlarged glands both tubercular and Hodgkin's, certain types of eczema, superfluous hairs, and many other superficial lesions. Diseases of the liver, stomach and uterus, and tuberculosis of the lungs and bones, are not suitable for the rays.

While it is well to be conservative there is just as much danger in being too conservative as in being too radical. It seems to us that with the improvements in technic which are being rapidly effected, and with the encouraging results reported in cases in which the technic has been properly looked after, we have every reason to expect that diseases of the stomach, intestines, lungs, liver and bones will be nearly as amenable to x-ray treatment as those that are nearer the surface.

### Photo Therapy.

#### Finsen Light.

Dr. R. H. Stevens, Detroit (*N. Amer. Jour. Homeopathy*, October, 1903), describes the Finsen ray apparatus, calling attention to the fact that Finsen depends upon the intensity of the light and not simply upon the ultra violet rays. The ultra violet rays are the most bactericidal but have also the least power of penetration. Dr. Reyn, one of Finsen's assistants, has perfected a similar and

cheaper apparatus for treating one patient at a time. This lamp requires twenty amperes, and is placed much nearer the patient so that it is just as effective as the larger lamp. The light from it will kill bacillus prodigiosus in less than a second. Dr. Stevens quotes from Finsen's report on 840 cases of lupus of which 695 were greatly benefited if not entirely cured. In lupus erythematosus out of forty-four cases fourteen have been cured.



Epithelioma cutaneum, twenty-four cases, eleven cured. Acne vulgaris, twenty-five cases, eleven cured. Later results in similar cases have been even more successful.

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#### Violet Rays in Treatment of Tuberculosis.

Dr. J. Mount Bleyer, New York (*Medical Brief*, November, 1903), finds that violet rays from the electric arc are rank as one of the greatest tonics in bacterial diseases. Of sixty cases of tuberculosis he reports forty cured and the disease arrested in the other twenty. This treatment must not be given homeopathically. Exposures must be not less than half an hour over the selected area. Good carbons are very important. Along with this treatment hygienic food, fresh air, exercise and such remedies as are indicated will cure 75 per cent of tuberculous patients; the cure being partial or complete, according to the pathological condition then present. He prefers concentrated sunlight where this can be obtained. The arc lamps should have no lenses whatever, as glass is nearly opaque to ultra violet rays.

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#### The Solar Cautey.

Dr. O. V. Thayer, in the *Pacific Medical Journal* for September, contrasts other methods of treatment for malignant growths with his solar cautery. He states that during the last thirty years he operated more than 2,000 times with concentrated sunlight and has yet to find any case of injury from it. "Unlike other caustics and cauteries, it can be applied to delicate membrane or tissue; and inflammation following its application is surprisingly slight and of short duration. The pain subsides immediately upon removal of the lens. Blistering is avoided, as the burning is carried beyond that point. The abnormal tissues are carbonized. In the treatment of all morbid growths these must be fully destroyed.

Upon this depends the success of the operation. The tissue must be thoroly desiccated before cremation takes place. If the solar heat is applied for more than a few minutes at a time the fat in the tissue is melted and effusion of serum is increased, preventing further destruction. After waiting for a short time for the part to cool the application is renewed, and continued from time to time until the job is accomplished. The part is then dressed so as to thoroly protect it from the air. In three or four days carbonized material is thrown off leaving a healthy sore, which is treated as any ordinary wound. The resulting cicatrix is very slight." He claims that there is very little pain, less treatments are required, there is less constitutional disturbance and greater probability of cure than by other methods.

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#### Effect of Light and Heat Rays on the Temperature of the Skin.

—An interesting series of observations have been in a series of about one thousand cases with the aid of Herz's apparatus, by E. Sommer (*Berl. klin. Woch.*, October 5, 1903). This apparatus is essentially a differential air thermometer, furnished with an alcohol manometer. Incandescent electric lights in blue, red, yellow and green globes were employed, the lamp being held about 10 cm. from the skin for a period of ten minutes. It was found that the skin over chronically inflamed joints was lower than on the healthy side, unless an acute exacerbation of the process was present, in which case the relations were reversed. Under the influence of warmth and light radiation the temperature of the side treated always rose above that of the other side; but there were certain cases noted in which the temperature after exposure to the rays was less on both sides than before. Radiation of this type does not produce a reaction in the sense of a cooling, with

the same regularity as results from the application of heat and cold by other methods. The effects of the rays with a short wave length are of longer duration than those with long wave lengths. After two or three hours the relations change, the side exposed seems colder than the other, a condition which is apparently due to the reactionary rise on the side which was not exposed.—*Medical News.*

Prof. R. W. Wood, of the Johns Hopkins University, has discovered that nitroso-dimethylanilin, when combined with cobalt glass, furnishes a screen which allows only ultra-violet rays to pass thru.

**A Lightning Conductor.**—An interesting episode is thus noted by the *St. Louis Globe Democrat*: "Some kind of a memorial should be presented to the engineer of the cogwheel railroad on Pike's Peak. Being struck by lightning and stripped of his clothing, he calmly attired himself in a Navajo blanket and continued his duties. We must ever feel an unquenchable admiration for such sprightly unconcern. It is quite customary when struck by lightning to make a great fuss about it; to demand the services of everybody in the neighborhood for our resuscitation and to bring the business we may have had in hand to a dead standstill."

## Electro Therapy.

### Electricity in General Practice.

Dr. W. B. Neftel, New York, in *The Medical Record*, November 28, gives a brief summary of the development of electrotherapy and describes a number of cases in which electric treatment has been of the highest value in his practice. He speaks also of the very great value of the electro diagnosis in many otherwise obscure cases. He uses merely the galvanic current and the faradic machine, two of the simplest forms of apparatus which are easily made use of by any physician, and gives in detail his method of treating the motor nerves, brain, sympathetic nerve, pneumogastric nerve, spinal cord, and neuralgic and other conditions.

"The costly, complicated apparatus should be left to the specialist, neuro-pathologist and electro therapist for therapeutic purposes and scientific researches."

### Treatment of Pulmonary Tuberculosis With High-Frequency Currents and Inter-Laryngeal Injections of Antiseptics.

High-frequency, low-potential alternating currents have been used by Dr. J. Cunningham Bowie for treating pulmonary tuberculosis, with some degree of success. He found that the passage of a current of electricity thru toxins considerably modified and annulled their toxicity, and that the greater the volume of electricity used the more quickly this was accomplished. He concluded that electricity might be of value in the treatment of phthisis or other diseases where bacterial toxins had to be contended with. For this purpose an apparatus which would develop a fairly large current at a high frequency was necessary, and this apparatus should make it possible to regulate the frequency, the voltage and the current at will. An apparatus of this kind

was constructed and has been used in a number of cases, the results of which he gives. Almond oil, containing iodine, thymol and other antiseptics, was used for intralaryngeal injection. The current density varied from 300 to 800 milliamperes; the voltage from fifty to seventy, and the time of application from ten to twenty minutes. The arrest of lesion was brought about by this treatment more quickly than by the use of antiseptic oils alone, and the author's experience shows that the high-frequency current promotes healing.—*Abstracted from the Lancet (London), October 31, by Electr. Rev.*

**Some Principles on which is Based the Therapeutics of Electricity in Nervous Diseases.**—A. D. Rockwell believes that the reasons why so many physicians are disappointed in the results of electrical treatment are: (1) Ignorance of the physics and physiology of the method employed. (2) Imperfect technique. (3) Failure to appreciate the differential indications for the use of the various modalities. He then discusses the conditions presented by various common maladies so far as indications for the employment of electricity are concerned. Concerning true neuralgia, he notes that pressure invariably increases the pain, while in pseudo-neuralgia it often affords relief. In these cases the local application of the cathode is to be preferred to that of the anode. Not only this, but the faradic current itself is peculiarly effective in such cases, and will give relief when the galvanic utterly fails.—*N. Y. Med. Jour.*

#### Heat Radiation of Incandescent Lamps.

Fischer (*Zeit. f. Beleucht.*, July 13, 20) gives the results of a scientific investigation, in order to ascertain how much of the energy of the current appears in the

form of heat and of light in the ordinary incandescent lights. For these experiments he used an incandescent lamp of 110 volts, having resistance, when cold of 300 ohms. The heat energy was measured by a thermopile, and the light energy by a prism-photometer. Several tables of results are given, showing that by far the major part of the electrical energy is converted into heat. With a current of .317 amp. the author finds 99.82 per cent appearing as heat and only .14 per cent as light, the latter gradually rising to 26.5 per cent when the current had increased to .718 amp.; the lamp was then giving about 32 cp. Under the normal conditions of the 16-cp. lamp, the author found 85 per cent as heat and 15 per cent as light, with a current intensity of .621 amp.—*El. World and Eng.*

#### A Method of Reversing Influence Machines.

When desirable to reverse the polarity of an influence machine, the usual method of procedure is to ground both terminals, give the machine a few turns in the opposite direction, then remove the grounds and start the machine normally. The effect of this operation is rather uncertain, and Herr J. R. Januszkiewicz has devised a system which is more reliable. In this one pole of the machine is connected electrically to the inducing plate for the opposite pole. The machine is then revolved in the normal direction, and if the connection then be broken, the polarity of the machine will be found to be reversed. If the machine is running at a fair speed, but a momentary connection is needed, while if it is running slowly, it may be necessary to leave the connection for ten or fifteen seconds. Care should be taken that good electrical contact be made.—*Translated and abstracted from the Physikalische Zeitschrift (Leipzig), October 15 for Electr. Rev.*



## A Study of Light.—Ultra Violet Light.\*

BY J. MOUNT BLEYER, M. D., F. R. A., M. S., LL. D., OF NEW YORK CITY.

Wonderful as the nineteenth century has been in all that pertains to the development of science, the twentieth century promises in one respect at least, to surpass it. The nineteenth century may be regarded as the triumphant period of the medical philosopher, the Alexander of modern times, who has so little matter left to conquer. The twentieth century will be the apotheosis, so to speak, of the progressive doctor and his scientific colleagues who engage in the investigation of medicine and its allies.

Long ago philosophers remarked that their knowledge of nature was limited by the number of senses, and would probably extend itself if these were increased or even perfected; nothing, indeed, authorizes us to believe that the properties of nature are limited to those which affect the senses of man.

An objection may be raised to the fact that if such waves of light as those now under consideration are invisible, they can not be waves of light. If you were to lay down as a definition beforehand that the term "light" must be applied only to the waves that are visible to the human eye, there is nothing more to be said. But let me say that science has given us other eyes, or other processes that will enable us to observe these invisible Ultra-Violet waves of light! It is found that these invisible waves agree with the visible waves in other important respects, that they can be reflected, refracted, polarized, and diffracted, and we are bound to notice them as light. They may have wave lengths that are longer than that of the red waves, or smaller

than that of the violet waves, and so our eyes, with their limited range of perception, fail to be sensitive to them; nevertheless, if in their physical properties they agree with the invisible kinds, then the fact that to us they are invisible simply demonstrates the natural shortcomings of our sense of sight.

It has been supposed that some animals may have the power of distinguishing such colors of light; that is, that their eyes are affected by those rays of high refrangibility which produce no impression of light upon the eyes of man. M. Biot has, it would appear, found that some such effect is produced by rays upon the eyes of some of the night-roving animals by rays invisible to us. This may be, that which is colorless to us when we come from the sunshine into it is found, after a little time, when the lenticular arrangement of the eye has been adjusted to the required condition, to produce the sensation of tolerable light. May we not, therefore, explain on the same principle the power which the cat, the owl, and other animals possess of seeing in the circumstances we might regard as darkness.

At the extreme end of the spectrum, beyond the violet, we have these waves which are called invisible by reason of being of too small a size to affect our eyes by direct vision—and these very ones interest us at present mostly on account of their special therapeutical value, and other physical properties that they possess. They are known to be active in producing certain chemical effects, notably the photo-chemical or photographical. They also produce certain physiological effects on animal and vegetable tissues, they actively provoke in certain

\* Read before the American Electro-Medical Society at Chicago, December 1-2, 1903



bodies the property of shining in the dark, phosphorescence and fluorescence, and, lastly, they have certain electrical properties. These waves have earned for themselves the names of actinic, photographic, or ultra-violet.

Theoretically we know the extreme probability that rays in a beam of light will scatter if the beam passes thru a prism, and we find in practice that when a beam of sunlight is passed thru a prism the rays are so far scattered as to produce a spectrum very much wider than the original beam, and made up of a series of differently colored bands of light, of which the first is a red band, the next an orange one, the next a yellow, the next green, the next blue, the next indigo, and the last violet. Now we learn in regard to the spectrum, as Professor Stokes first showed, that when the spectrum is allowed to fall on certain substances, a band of colored rays, called the ultra-violet rays, becomes visible, beyond the violet band which is ordinarily seen; and also under similar circumstances a band of ultra-red rays is sometimes visible beyond the red band which is ordinarily seen. All kinds of light in the visible spectrum are comprised between the extreme red at one end, and the extreme violet at the other. Their wave lengths have been computed, and vary between about 32 millionths of an inch (extreme red), and 15 millionths of an inch (extreme violet). But besides these waves of various colors between those limits, which are visible, there are other waves that bring no sensation to our eyes, which are called invisible, and yet are light waves. We have found that the greatest luminosity to the eye is possessed by waves having a wave length of about 22 millionths of an inch or 0.00055 of a millimeter. The greatest heating effect occurs with waves of about 40 millionths

of an inch, or 0.001 of a millimeter. The greatest chemical<sup>1</sup> effect occurs with waves of about 16½ millionths of an inch, or about 0.00041 of a millimeter.<sup>2</sup>

There are diversities of opinion regarding some of the physical, physiological and therapeutic behavior of the ultra-violet light. According to many experiments, it is found that the ultra-violet light is made visible to us in many hundreds of ways. Amongst the reliable ones, the spectroscope and its photography tell us how long the extreme end of the ultra-violet extends in the spectrum. We also know that the ultra-violet exists in different degrees of intensity as we go up in the scale—or its spectrum.

Fluorescent materials of many kinds give proof of the presence of the ultra-violet light, when these substances are subjected to it. There comes up a great question before us, tho I am now of the belief, from my own study, that the invisible light most active in producing the highest degree of physiological, physical and therapeutic results begins at the blue end of the spectrum, and becomes more intense at the ultra-violet. How far up in the scale it extends is a question which is not yet solved. The ultra-violet seems to be the most active, possibly at a short distance or degree above the violet end, and thence becomes less and less as it still rises in its own scale higher up.

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<sup>1</sup>There is an assumption that the effect is measured by a particular chemical reaction, viz., the darkening of chlorid of silver, if a different reaction, say, for example, the darkening of ferro-prussiate salts ("blue print," which are much slower for giving a reaction) were taken as a basis of measurement, the maximum effects would be found to occur at some after point in the spectrum." Prof. Sylvanus Thompson, "Visible and Invisible Light," Macmillan Co. 1897.

<sup>2</sup>A table of wave lengths, and frequencies of all kinds of light from the lowest—ultra red, up to the highest, ultra violet—has been added here.

TABLE OF WAVE-LENGTHS AND FREQUENCIES.

| Name of Line.                          | Color.   | Wave-lengths in<br>Micromillimeters<br>(Biotons.) | Frequency, millions<br>of millions, $10^{12}$ ,<br>per second. |
|----------------------------------------|----------|---------------------------------------------------|----------------------------------------------------------------|
| (Rubens and Nichols'<br>longest waves) |          | 24000.                                            | 12.5                                                           |
| (Langley's longest waves)              |          | 15000.                                            | 20.                                                            |
| (Paschen's longest waves)              |          | 9450.                                             | 31.7                                                           |
| (Psi)                                  | ....     | 2700.                                             | 111.                                                           |
| (Phi) <sub>1</sub>                     | ....     | 1240.                                             | 242.                                                           |
| (Phi) <sub>2</sub>                     | ....     | 1200.                                             | 250.                                                           |
| Y                                      | ....     | 899.04                                            | 333.7                                                          |
| Y                                      | ....     | 898.65                                            | 334.0                                                          |
| X <sub>4</sub>                         | ....     | 880.61                                            | 340.8                                                          |
| X <sub>3</sub>                         | ....     | 866.14                                            | 346.2                                                          |
| X <sub>2</sub>                         | ....     | 854.18                                            | 351.3                                                          |
| X <sub>1</sub>                         | ....     | 849.7                                             | 353.3                                                          |
| Z                                      | ....     | 822.64                                            | 364.5                                                          |
| A                                      | red      | 759.4                                             | 395.2                                                          |
| B                                      | ....     | 686.74                                            | 436.5                                                          |
| C                                      | orange   | 656.30                                            | 457.2                                                          |
| D <sub>1</sub>                         | ....     | 589.61                                            | 508.8                                                          |
| D <sub>2</sub>                         | yellow   | 589.02                                            | 509.1                                                          |
| D <sub>3</sub>                         | ....     | 587.60                                            | 510.5                                                          |
| E <sub>1</sub>                         | {        | 527.05                                            | 569.2                                                          |
|                                        |          | 527.04                                            | 569.2                                                          |
| E <sub>2</sub>                         | green    | 526.97                                            | 569.3                                                          |
| b <sub>1</sub>                         | ....     | 518.38                                            | 578.9                                                          |
| b <sub>2</sub>                         | ....     | 517.29                                            | 580.0                                                          |
|                                        | {        | 516.92                                            | 580.4                                                          |
| b <sub>3</sub>                         |          | 516.91                                            | 580.4                                                          |
|                                        | {        | 516.77                                            | 580.5                                                          |
|                                        |          | 516.75                                            | 580.5                                                          |
| b <sub>4</sub>                         |          | 486.15                                            | 617.1                                                          |
| F                                      | blue     | 486.15                                            | 617.1                                                          |
| G                                      | { indigo | 530.81                                            | 696.3                                                          |
|                                        |          | 430.79                                            | 696.4                                                          |
| h                                      | ....     | 410.18                                            | 731.3                                                          |
| H                                      | violet   | 396.86                                            | 756.0                                                          |
| K                                      | ....     | 393.38                                            | 762.7                                                          |
| L                                      | ....     | 382.06                                            | 785.1                                                          |
|                                        | {        | 372.78                                            | 804.6                                                          |
| M                                      |          | 372.71                                            | 804.9                                                          |
| N                                      | ....     | 358.13                                            | 837.7                                                          |
| O                                      | ....     | 344.11                                            | 871.8                                                          |
| P                                      | ....     | 336.13                                            | 892.6                                                          |
| Q                                      | ....     | 328.69                                            | 912.6                                                          |
|                                        | {        | 318.14                                            | 942.9                                                          |
| R                                      |          | 317.94                                            | 943.5                                                          |
| r                                      | ....     | 314.46                                            | 954.1                                                          |
|                                        | {        | 310.08                                            | 967.4                                                          |
| S <sub>1</sub>                         |          | 310.04                                            | 967.6                                                          |
| S <sub>2</sub>                         | ....     | 310.01                                            | 967.7                                                          |
| s                                      | ....     | 304.77                                            | 984.5                                                          |
|                                        | {        | 302.12                                            | 993.0                                                          |
| T                                      |          | 302.07                                            | 993.3                                                          |
| t                                      | ....     | 299.45                                            | 1002.0                                                         |
| U                                      | ....     | 294.80                                            | 1017.6                                                         |
| (Miller's limit, photo-<br>graphic)    |          | 202.                                              | 1485.1                                                         |
| (Stokes' limit, fluorescent)           |          | 185.                                              | 1621.6                                                         |
| (Schumann's highest fre-<br>quency)    |          | 100.                                              | 3000.                                                          |

These tables are taken, with slight modification, from a lecture on "Invisible Rays" by Sylvanus P. Thompson, D. Sc., F. R. S., M. R. S., London. Light Visible and Invisible. The Macmillan Company, 1897.

I want to make reference on this point to the recent researches of Professor Marshall Ward on the action of light upon bacteria and fungi. The outcome of the research showed that the bactericidal power was at its maximum in the blue-violet region and extended for an unknown distance into the ultra-violet. This observation is of great importance in connection with the application of light to therapeutics. I agree with these researches from my own observations.

We have the same example, and many experiments bear us out, to a short distance into the ultra-red, then, after that, we have less and less use for it as a therapeutic agent. In other domains of science both these extreme rays have their significance and experimental uses.

We should take these facts, now, as far as our knowledge of the subject allows us, as a safe basis to go on in our therapeutical application of these rays, until the future holds out a more positive experimental proof of the therapeutic efficacy of those still higher refrangible rays.

I have no doubt that I shall find some who will differ from me on these points, but from the many experiments that are already recorded I have come to these conclusions. In the papers to follow, I propose to cite from the various noted physical experimentalists their own accounts on the ultra-violet light, in order to help me to convince those who have doubts from a number of directions as to certain known laws which the ultra-violet rays should obey. My own experiments will follow, giving some important new discoveries on these ultra-violet rays. By following out this plan of collecting together the most important facts known to

others, and adding them to my own, the reader will be able to judge and comprehend the many valuable points ready to be intelligently applied in the practice of medicine.

Another question which confronts us is this: How to establish the true therapeutical and physiological effects by combining the different rays of the spectrum into one, or in their separated and isolated state from the infra-red state to the ultra-violet, or even more refrangible state?

This is a ripe hour to call the attention to the experimental therapist and physiologist. Also we must not forget that dosage of any of the isolated lights of the spectrum will require some thought, each one of them separately, as well as the combination of all of them together in a mixed state. The quality and quantity of the different rays must also receive careful consideration. From what I have learned by experiments, I am well satisfied that these are some of the salient points requiring further careful experimenting. These questions are the coming themes for solution, if we wish to apply light intelligently.

If we desire for experimental purposes to separate the waves which can produce one of these effects from those which produce another, there are several courses open to us. Let us begin to sift out the ultra-violet waves from all other kinds—our method begins by the use of prisms which will disperse the waves, and sort them out into a spectrum according to their sizes. We may also accomplish the same thing by making use of a diffraction grating to produce a spectrum; also we may employ as a means of sifting sheets of different substances that have the power of absorbing waves of one sort, while transmitting those of another. This method was found a good way when applied to visible rays, for by using a red

colored glass it was possible to cut off all the other colors, and leave only the red. It is much to be regretted that no perfect filter screen exists that will cut off all the visible rays, yet allow the passage of the ultra-violet waves. I have found that glass which is tinted a deep violet color with manganese, or with manganese and cobalt, serves very well to cut off most the visible light, while transmitting a fair proportion of the ultra-violet waves, mixed with some violet light.”<sup>3</sup> The fact has been long known to me, and my experiments were satisfactory on that point, and found that blue glass for many purposes is good enough. “It is said, unfortunately, that every kind of glass cuts off the extreme part of the ultra-violet light; even the lightest crown glass, tho moderately transparent to waves of 15 millionths to 11 millionths of an inch long, is totally opaque to all waves smaller than 11 millionths, while dense flint glass (containing lead) is opaque to everything beyond the wave length of 13.3 millionths of an inch. Hence, for experiments on ultra-violet light, it is expedient not to use glass lenses or prisms, provided some more transparent medium can be found.” Happily, both quartz and fluor-spar are much more transparent to ultra-violet waves than glass. Quartz transmits them down to 8 millionths of an inch, and fluor-spar down to 8 millionths.”

This same stand is taken by most physicists, but it is not altogether correct. A vacuum tube of any given shape or size is exhausted by means of an exhaust pump to a point below a Geissler vacuum; and when a purple violet color is coming into view the tube should be sealed at that point of vacuum and removed. All my experiments (which are in the hundreds) showed that such a tube became capable

<sup>3</sup>Prof. Sylvanus P. Thompson, “On Light.” 1897.



of generating ultra-violet rays when the tube was placed in circuit with the coil or static machine. These rays have a high efficiency of penetration, and pass thru glass. Many tests to which these ultra-violet rays were put, like with the fluorescent screen made of platino-cyanid of barium or Willemite, gave a highly fluorescent exhibition—even fluorescing thru one-eighth inch to one-quarter inch of glass lenses.<sup>4</sup>

Several photographs were taken by means of these rays with a camera in a dark room. This gave a good test for the rays as to their quality, showing that these active chemical rays, which are known not to pass thru glass, made a fine impression on the photographic plate. Even if the sensitive side of the plate is placed facing the inner side of the camera, and the plain side of the glass toward the lens, the ultra-violet light thus passing first thru the glass lens, and hence to and thru the glass of the plate in order to reach the film, a good picture was always the result.

This again shows that glass is not an entire obstacle to this class of rays, as generated in these tubes. Exploring the spectrum with these rays, we find that they occupy a space high up in the ultra-violet region.

To Professor Henry G. Piffard, of New York, credit should be given regarding some of his excellent experiments on ultra-violet rays and their applications. I take the liberty to quote from his last contribution,<sup>5</sup> tho I do not agree with his view that the power of these rays to penetrate glass is nil. Others make similar assertions, but, nevertheless, this class of

rays which are generated in vacuum tubes do pass thru glass, as I have shown.

Dr. Piffard says: "Insomuch as the ultra-violet rays are invisible, it may be asked how we determine their presence. In other words, is there any convenient test by means of which their existence or absence may be readily ascertained? One test mentioned by many writers is that performed by aid of the electroscope. If a goldleaf electroscope be charged with negative electricity, the ultra-violet rays will discharge it; but if charged positively, they do not affect it. The most convenient test, however, for the presence of the ultra-violet rays that is known to me is by means of the mineral Willemite, a silicate of zinc ( $\text{ZnSiO}_4$ ), which exposed to the ultra-violet rays exhibits a beautiful greenish fluorescence. If, however, a thin piece of glass, as an ordinary spectacle lens, be interposed between the rays and the mineral, the fluorescence instantly disappears, showing, as already stated, that the rays do not traverse this medium. If, however, a thin quartz plate be substituted for the glass, the fluorescence again becomes apparent.

"If we now expose a piece of Willemite to the x-rays it will fluoresce as before, but the fluorescence will persist even if glass be interposed."

Dr. Ledue, of Paris, observed another source of ultra-violet rays, which, he found, came off from the negative end of a Geissler tube. Professor Piffard found that if a piece of Willemite be placed at the negative end of such a tube it fluoresces, though not vividly, but he says: "This phenomenon is puzzling in view of the fact that the ultra-violet rays are not supposed to traverse glass, and if it, indeed, be those rays that have induced fluorescence, they must have been generated outside of the tube, and be due to the electric stress, with, of course, the proba-

<sup>4</sup>For detail explanation "On Fluorescence," see July number Medical Examiner and Practitioner, "Study on Light," a series of articles, by Dr. J. Mount Bleyer, of New York. 1903.

<sup>5</sup>Radio-Praxis, by Henry G. Piffard, M. D., LL. D., Medical Record, March 7, 1903.



bility that they are not ultra-violet rays." This expression of opinion by Drs. Piffard and Leduc has some weight, but is not conclusive.

I found that all vacuum tubes at a certain degree of vacuum give off ultra-violet rays and x-rays.

I am convinced that what is seen in the form of fluorescence in the low exhausted Crookes tube is not fluorescence, but x-rays of a low degree. Dr. A. Goldhammer strongly advocates this view; he says: "The tendency at present is to believe that the x-rays are waves of ultra-violet light of much smaller dimensions than any that have been hitherto detected.<sup>6</sup> Professor Roentgen's reasons for believing that the new radiations discovered by him were not those of ultra-violet light were as follows:

"(a) The x-rays suffer no refraction in passing from air to water, bisulfid of carbon, aluminum, rock salt, glass, zinc, etc.

"(b) They are not regularly reflected by known bodies.

"(c) They cannot be polarized by known means.

"(d) The density of a body apparently more than any other factor influences their absorption.

"If the x-rays are very short transverse waves of light, which are too small in comparison with unevenness of highly polished substances to be regularly reflected or polarized, b and c can be explained. When we consider also the phenomenon of anomalous refraction and dispersion, the behavior of the so-called x-rays is not so remarkable. Certain substances, like fuchsin and anilin, exhibit anomalous refraction, while substances like glass exhibit normal refraction, the

violet rays being more refracted than the blue rays."

In certain cases of anomalous refraction and dispersion, the amount of refraction (index of refraction diminishes as the length of the wave grows shorter.<sup>7</sup>

Goldhammer therefore concludes that as c can be thus explained by anomalous refraction and dispersion, together with the hypothesis that the x-rays are ordinary transverse vibrations of the ether, such as constitute ordinary ultra-violet light: "The wave length of the x-rays is, however, much smaller than those of any hitherto observed ultra-violet light."

By numerous experiments I found some very peculiar incidents, which agree in many respects with those of Goldhammer. If the hand or finger, or any metallic or other substance is held directly against one of my ultra-violet tubes, the fluorescence which appears over the entire tube will immediately be deflected to one concentrated point. If a platino-cyanid screen then be placed against the deflected point in a dark room, x-rays will show themselves. I am satisfied that all vacuum tubes of either high or low kind will give off x-rays, whether an anode is fixed within or not. The higher the electro motive force employed in experimenting with these vacuum tubes, the larger quantity and quality of the x-rays will be found to exhibit themselves.

I increase the efficiency and regularity of this ultra-violet tube by placing it in circuit either to the static machine or to the induction coil, and attaching a simple apparatus which is made up of multiple gaps. These multiple gaps increase the electro motive force of the current to an enormous degree. The current feels almost the same as from a high frequency

<sup>6</sup>Annalen der Physik und Chemie, No. 4, 1896.

<sup>7</sup>John Trowbridge, S. D., "What is Electricity?" New York, D. Appleton & Co., 1896, The International Scientific Series.

apparatus. Such arrangement is an important piece of mechanism, and will also be found useful for other light frequency work or for vacuum tubes, etc. This multiple spark gap apparatus is here shown in this illustration—also the high frequency tube of my own design. The peculiar style of current of high electro motive character which I generate by these multiple gaps will be found equal to any high frequency current.

Single spark gap attachments are found on many of the so-called high frequency and hyperstatic machines, but I believe I am the first one to utilize the graded multiple spark gaps of from a twentieth to a sixteenth of inch space between the gaps of these apparatuses for therapeutic purposes. These multiple gaps help most wonderfully to raise the electro motive force, and increase the oscillations to a high degree. Nothing will prove the truth of my assertions so much as a practical demonstration with the vacuum tubes which are used for application of the high frequency current.

I present two of my multiple spark gap apparatuses here. One of them is arranged, as seen in the cut, to fit in between the sliding poles of any static machine. The sparking distance is arranged by sliding apart the rods, which then gives any size spark between the rods and the center ball on the spark gap, from which the secondary impulses are then directed down to the grade multiple gaps, which are separated a twentieth of an inch or more. These small graded sparks occur between the rings, which are mounted on a glass rod, and so connected that as many may be thrown into the circuit as wanted. The result attained by such an arrangement is that they give the finest impulses, mostly all of a high frequency quality. These multiple spark gaps are enclosed in a hard rubber case, making

the whole appear like a mounted coil. The entire apparatus may be shifted to any part of the room when not in use, or left connected. The manufacturers are Van Houten & Ten Brook, New York City.

Another important induction coil multiple spark gap mechanism, which I constructed and introduced, is a piece which is made for direct connection to the induction coil. This coil and multiple spark gap has all the qualities that is possibly to be desired for any class of work. The coil, as here illustrated and to which the multiple gaps are attached, is a new model, constructed on entirely new lines, by Dr. Harry Waite. It can be placed in both circuits, alternating or direct.

For these vacuum ultra-violet rays I claim the most remarkable power of penetration, even in semi-opaque substances; and active chemical or photo-chemical action. It is also a cold light, and can be applied to any region of the body, internal or external. It runs noiselessly when connected to static machine or induction coil.

No burns or sparks are left on the patient's skin after any lengthy exposure. It can be operated in most simple fashion by anyone having the slightest experience in x-ray technique, as the method of applying these rays is almost the same.

The construction of these various kinds of tubes differs only in size and pattern; the vacuum is always the same. The life of the tube is long, as it can be operated for hours without deterioration to its rays. When worked with an induction coil for some time, the vacuum is raised, and the ultra-violet rays become changed; so in order to obviate that, a standard regulator is placed on all coil tubes, to lower the vacuum and to bring the ultra-violet rays back to their original state.

While this article was in preparation I still continued experimenting, in order to

produce the best possible ultra-violet tube, which would yield at all times the largest quantity and quality of ultra-violet rays, and hold its vacuum permanently without variation. Mr. Machlett and myself have now produced a tube which has all the best requisites embodied in its construction. I, however, regret that I was just too late to reproduce an illustration of this latest model. A few words will suffice to explain the most salient good points. The tube has no leading inlets or electrodes within the vacuum. The electrodes are made of simple brass band contacts from the outside, and the vacuum is reached by induction. These essential points give the vacuum a long life.

I bring this new method of generating ultra-violet rays to your notice. I do so with the assurance that I am the first to make known the fact that these rays, as I have produced them in vacuum tubes, possess many advantages and no disadvantages as compared with the most costly lamps and complicated accompaniments. There are many different classes of lamps for generating these ultra-violet rays, but I believe there is no lamp which will give a better quality and more quantity of ultra-violet light than this modified Crookes tube. It is with this introduction that this vacuum tube makes its appearance, with a faith and hope that it will prove itself as I present it. Later on I shall take up the study of the physics of the vacuum tubes, which will give you a close insight into its laws, etc.

My experiments are finished, and I turn this tube over to my colleagues for further clinical experience in the various diseases in which the ultra-violet rays are made applicable.

These vacuum ultra-violet generating tubes (Mount Bleyer's) are now found on the market, and made for me in my own patterns and sizes to suit almost all wants. M. E. Machlett & Sons, 143, 145

and 147 East Twenty-third street, have taken much pains in bringing a tube of this character to such a successful issue, that I am indebted to them for their aid, and also to R. Friedlander & Co., Chicago, Ill.

For many scientific researches there is no doubt that quartz and fluor-spar have their prominent places, but for therapeutic purposes these ultra-violet vacuum tubes possess enough of the quality of transmitting the ultra-violet rays thru the walls to warrant their reception as most welcome instruments. I will refer to them later.

Quartz has the power of transmitting the ultra-violet rays far more completely than glass. If, therefore, the glass lens and prism of a projection spectroscope be replaced by a quartz lens and prism, the ultra-violet part of the spectrum is rendered much brighter, and is extended still further than before.

The existing view among physicists, whose authority lends much credit to such views and opinions, is that ultra-violet rays are obstructed by glass. I have, however, for several years, held and based upon authority and upon experimental research, that the ultra-violet rays do pass thru glass. The reader must bear in mind that my work resulted from the discovery of Hertz, that the kathode rays might be transmitted to the outside of the generating discharge tube. Passing from these introductory remarks, the characteristics of the several variety of tubes that I employed will be explained. I made use of several kinds during my experiments, but soon settled down to one; the essential elements of which are shown in the figures. A tube of the kind seen in the illustration was made and connected to an exhaust pump and the air was removed until the ultra-violet ray made itself visible on tests. Opposite the kathode I constructed a window which



consisted of a thin slice or disc of quartz, secured fast by several methods, either of which was sufficient to hold the quartz disc in position. It is called a quartz window. The greater part of this discharge tube (the Mount Bleyer Ultra-Violet Tube) was made of glass. The anode was made from one of the ordinary aluminum discs, seen in all x-ray tubes, and sealed within the discharge tube. The anode and cathode were placed at equal distance, so that the ultra-violet rays were equally distributed. The window was placed in the center of the tube, which is observed plainly in the illustration. The different tubes gave equal results. I found that these ultra-violet rays gave to all the tests known equal quality thru the glass window sides as thru the quartz window. Side by side these comparisons were made, and hardly any difference was possible to be detected.

These quartz window tubes (Mount Bleyer's) will be placed on the market for the sole benefit of those who desire to have quartz lenses and are desirous of testing the difference. (Machlett & Sons, New York.)

But the ultra-violet rays of the spectrum can be seen without the intervention of any fluorescing substance thru a glass or, still better, thru a quartz prism, if the bright part of the spectrum between B and H (Fig. 8) be carefully shut off. With feeble illumination its color appears indigo blue, but with light of greater intensity it is of a bluish gray tint (lavender). The ultra-violet rays thus ordinarily escape observation, because they produce a much feebler impression on the human eye than the less refrangible rays between B and H.

We already have learned to know that there are rays which are still more refrangible than the violet, but which in the ordinary mode of projecting the spectrum are invisible; these are the ultra-violet

rays. They become capable of exciting fluorescence, apparent in any solution, as quinin or esculin, a substance contained in the bark of the horse-chestnut. If sunlight is used for such an examination, the well-known Fraunhofer lines appear upon the bluish ground of the fluorescing spectrum, not only from G to H, but the ultra-violet part appears filled with numerous lines, the most conspicuous of which are indicated by the several letters L to S (Fig. 8). That these lines, like the ordinary Fraunhofer lines, belong properly to solar light and do not depend upon any action of the fluorescing substance is evident from the circumstance that with the electric arc light they are no more apparent in the ultra-violet than in the other colors, and, further, because the same lines are seen in the solar spectrum, whatever may be the fluorescing substance under examination.

An explanation is thus afforded why such a solution as esculin or quinin is colorless when seen by transmitted light, for it absorbs only the feebly luminous violet, and the light that has passed thru it still appears white, and is not rendered materially fainter.

If the solar spectrum be thrown in the above-mentioned manner upon the fluid, its fluorescing part everywhere exhibits the same bluish shimmer; and spectroscopic examination shows that this bluish light has always the same composition, whether it is excited by the G rays, or by the H rays, or by the ultra-violet rays, and that it is formed of a mixture of red, orange, yellow, green and blue. It is thus seen that the different kinds of homogeneous light, so far as they are generally effective, produce compound fluorescent light of identical composition, the constituents of which, nevertheless, are collectively less refrangible than, or are at most equally refrangible with, the exciting rays.



Among other fluorescing bodies may be mentioned the slightly yellow petroleum, with bluish fluorescence, the yellow solution of tumeric with green, and the bright yellow glass containing uranium, which fluoresces with beautiful bright green fluorescence, platino-cyanid of barium, Willemite, and a host of others. Thomas A. Edison has examined over one thousand such materials and myself several hundred, both of a liquid character and in dry state. It admits of very easy demonstration that in these bodies also it is the more refrangible rays that call forth fluorescence. For, if we illuminate them with light which has passed thru a red glass, no trace of fluorescence is visible. But if the red be exchanged for a blue glass, the fluorescence becomes as strongly marked as with the direct solar light. A remarkable phenomenon is presented in the splendid light green light which is emitted by uranium glass under the action of blue illumination. The highest class of fluorescent exhibition can be gotten when the electric arc light is screened over with blue glass. This exhibit I have often showed to scientific men and my own colleagues, with much admiration on their part.

The highly refrangible rays which possess in so high a degree the power of exciting fluorescence, are contained in a large proportion in the light emitted by a Geissler tube filled with rarified nitrogen, or by the ordinary air. In order to expose fluorescing fluids to the influence of this light, the arrangement represented in Fig. 10 may be employed with advantage. A narrower tube is surrounded by a wider glass tube, into which the fluid is introduced by a side opening, and is then closed. Another form of Geissler tube is represented in Fig. 11, which contains in its interior a number of hollow spheres composed of uranium glass. Where a beam of reddish ultra-violet nitrogen light

transverses the tube, the uranium glass balls show with a beautiful bright green fluorescent light. The electric light, passing between the carbon points, is rich in rays of high refrangibility; indeed, the ultra-violet end of its spectrum reaches even farther than that of the solar spectrum. In the light of the magnesium lamp the ultra-violet rays are also abundant, and it has also been shown that in the Welsbach light a large quantity exists. These sources of light are, therefore, particularly well adapted to produce fluorescence, while gas, candle light and the incandescent electric lamps are nearly inoperative on account of the small amount of the more refrangible rays they contain.

It would, nevertheless, be incorrect to infer from the above facts that the more refrangible rays exclusively are capable of exciting fluorescence. An alcoholic solution of naphthaline red in ordinary daylight fluoresces with orange-yellow tints, whose unusual brilliancy will serve to demonstrate that even the lesser refrangible rays are capable of producing this effect. In fact, if the spectrum be projected upon the glass cell containing the fluids (Fig. 9), the yellow fluorescent light will be seen to commence at a point intermediate to C and D, and therefore still in the red, and to extend over the whole remaining spectrum, as far as the ultra-violet. The strongest fluorescence by far is shown behind the D in the greenish-yellow rays. It then again diminishes and becomes a second time more marked between E and B; thence onward, the fluorescence becomes fainter, then increases again in the violet, and gradually vanishes in the ultra-violet. In naphthaline red, therefore, there are rays of lower refrangibility, namely, the green-yellow rays behind the D, by which its fluorescence is most powerfully excited.

*(To be continued.)*

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DR. CARL BECK.

One of the first Physicians in the World to treat Sarcoma with the X-Ray.

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## Principles of Electro-Therapy.\*

BY H. PRESTON PRATT, M. D.

CHICAGO, ILL.

The discovery and study of the Roentgen ray and radium has thrown more light on and gives us a better idea and conception of the constitution of matter than all other experiments and discoveries put together since the time of Gilbert. It has assisted us materially in the study and development of electro therapy. It has developed the electron theory, which gives us clearer conception of the relationship of electricity to matter, thereby partially explaining the association theory.

Faraday believed that there was no flow of currents over the wire but that motion was imparted to the polarized molecules of the conductor. Berzelius after him classified fifty-six of the eighty odd elements in relation to their electrical activity, he believing that every molecule was a magnet or the equivalent of one. In this classified list, oxygen was considered the strongest electro-negative while potassium was the strongest electro-positive.

The one fluid theory was first suggested by Sir William Watson and afterward elaborated by Dr. Benjamin Franklin. Shortly afterward followed the two-fluid theory of Robert Symmer. Lodge suggested that all matter consists of two kinds of electricity, a positive and a negative charge interwoven and composing what is known as the ether.

The number of theories advanced are as numerous as the letters of the alphabet. So far no theory has thrown much light on the subject. All physicists up to the electronic epoch seem to agree that all electrical conditions of the atoms are transitory. None so far believed the charge to be stationary.

In review of the work of Faraday, Berzelius and others, the writer can see a chain of evidence which would lead up to the electron theory. First, Faraday believed that all matter over which electricity passed became polarized. Second, Berzelius believed that every molecule was a magnet or the equivalent of one, and he went so far as to classify fifty-six of the eighty odd elements in accordance with their electrical activity. Third, J. J. Thompson believed that all elements were built up of corpuscles or electrons. Fourth, Dr. Oliver Lodge says these corpuscles constitute electricity. J. J. Thompson claims that an atom of hydrogen is composed of seven hundred negative electrons. He was unable to detect positive ones, and to determine the number of electrons composing an atom of any element he simply multiplied the atomic weight of the element by seven hundred.

Professor Rutherford claims to have found the long looked-for positive electrons, and that they are much larger than

\*Read before the American Electro Medical Society, Chicago, December 1, 2, 1903.



the negative ones and also that they travel at a much less rate of speed. In almost all of the experiments endeavoring to demonstrate the electron theory, the Ruhmkorff coil or a static machine, vacuum tubes and magnets were used. So far it would seem to an ordinary observer that from the following up of the early experiments and the opinions expressed of the above physicists that there are in fact two kinds of electricity, every element assumes one or the other polarity. In other words oxygen carries a negative charge and potassium a positive one, but no one assumes that it was possible for each element to carry both signs.

The writer has made both electroscopie and electro magnetic tests which suggest that possibly oxygen, while it presents on its exterior surface a negative charge, at or near its center carries a positive one, and the reverse condition in the case of potassium.

Careful experiment with the pith ball or the Faraday bag suggest that while the outer surface of both are of one polarity the inner surfaces or centers are of the opposite sign.

It seems to the writer that there is one valid reason for us to assume that electricity is the essential or fundamental unit so far as the elements are concerned, and that is the fact that their atomic weights never vary.

This is also true of the molecular weight which is the sum of the atomic weights. The reason for this, according to the writer's way of thinking, is: First, that all atoms are built up of electrical units (electrons) having both signs; second, that all atoms are influenced according to their polarity; third, that in obtaining the atomic weights, gravity, which is purely an electrical phenomenon, exerts its polar influence on the elements

being weighed, the same as one mass or magnet would influence another.

The writer is of the opinion that physicists may yet demonstrate that the negatively charged electrons may, like the element oxygen, or the negatively charged pith balls, contain a positive charge, while the newly discovered positive electrons, as in the case of potassium, has also its negative sign. This recalls a belief advanced by Prout many years ago, that there is only one element in the universe, and that was hydrogen, which according to the above theory would be composed of about seven hundred of these corpuscles or electrons. That is to say an increase of the number of electrons would constitute a different kind of atom.

The discovery of radium in the opinion of some physicists has placed a different aspect on the electron theory. For instance, radium when highly active sends out light impulses resembling shooting stars.

It is the opinion of some physicists that this condition of affairs will continue uninterrupted without any apparent loss, while others say that radium will deteriorate in time. It is a well known fact that the sun throws out its force, producing ionic changes in mother earth and the surrounding atmosphere. These rays are constantly changing the position of the elementary structures in nature, so that while oxygen is stored up in the plants in day time it is given off at night, following the principle of a storage battery.

A simple storage battery consists of two sheets of lead oxide ( $\text{PbO}$ ) immersed in a solution of sulfuric acid and water. After the battery has been charged the positive plate is reduced to spongy lead ( $\text{Pb}$ ) while the negative plate is changed to peroxid ( $\text{PbO}_2$ ). When the battery is discharged the negative plate is reduced to oxid of lead ( $\text{PbO}$ ). The other atoms

of oxygen pass over to the positive plate, forming lead oxid, the same as before the battery was charged. The principle is very simple—during the process of charging the atom of oxygen is driven off from the positive plate to the negative and will remain there as long as the charging energy continues, after which it is eager to get back again. When it does the battery is discharged. This is due to difference of the electrical pull.

It is the writer's opinion that the same thing takes place in the case of radium. It is affected by the sun rays in the same manner as the oxygen in the storage battery, its activity depends upon the electrical pull. Radium loses its activity the same as the storage battery does its charge, and its quick recovery is due perhaps to the sun rays storing up more energy—the same as with the storage battery while being charged.

I think in summing up this part of the subject another feature must be taken into consideration: It is yet to be determined what part the law of harmony plays in Nature's great laboratory, its measured time, valency and color.

Making the allowance for the differences in the crude apparatuses used for experimental demonstration, I think we are justified in assuming that each electron is an electrical unit, representing both signs, and that an accumulation and arrangement of these units in relation to their signs constitute the atoms, that the atomic weight would represent in a measure the constancy of the force, and that all chemical changes are due to the difference in the electrical pull between the elements. It may be possible that the number of corpuscles or electrons hitched up in measured time gives to the atoms their existence as well as color.

The above was pointed out by the writer in an article published in the *Alkaloid*

*Clinic* of November, 1889, entitled "Electricity as an Antiseptic," and I am still of the opinion that these electrons form harmonic groups and that the number of octaves in the group or chain determine the nature of the element.

The human body is composed chiefly of fifteen of the eighty odd elements as follows: Carbon, hydrogen, oxygen, nitrogen, sulfur, phosphorus, chlorin, iodine, fluorine, silicon, potassium, sodium, calcium, magnesium, iron. According to J. J. Thompson.

An atom of carbon is composed of 8,400 electrons.

An atom of hydrogen is composed of 100 electrons.

An atom of oxygen is composed of 11,200 electrons.

An atom of nitrogen is composed of 9,800 electrons.

An atom of sulfur is composed of 22,400 electrons.

An atom of phosphorus is composed of 21,100 electrons.

An atom of chlorin is composed of 24,850 electrons.

An atom of iodine is composed of 88,900 electrons.

An atom of fluorine is composed of 13,300 electrons.

An atom of silicon is composed of 19,600 electrons.

An atom of potassium is composed of 27,300 electrons.

An atom of sodium is composed of 16,000 electrons.

An atom of calcium is composed of 28,000 electrons.

An atom of magnesium is composed of 16,800 electrons.

An atom of iron is composed of 36,200 electrons.

The most important salts of the body are as follows (each molecule containing a definite number of electrons):

1. Sodium chlorid, composed of 40,950 electrons.
2. Potassium chlorid, composed of 52,150 electrons.
3. Sodium carbonate, composed of 74,200 electrons.
4. Sodium bicarbonate, composed of 58,800 electrons.
5. Potassium phosphate, composed of 148,400 electrons.
6. Neutral calcium carbonate, composed of 70,000 electrons.
7. Acid calcium, composed of 113,400 electrons.
8. Neutral calcium phosphate, composed of 239,000 electrons.
9. Acid calcium phosphate, composed of 95,200 electrons.
10. Magnesium carbonate, composed of 58,800 electrons.
11. Magnesium phosphate, composed of 183,900 electrons.
12. Potassium carbonate, composed of 96,600 electrons.
13. Sodium phosphate, composed of 114,800 electrons.
14. Potassium sulfate, composed of 21,800 electrons.
15. Magnesium sulfate, composed of 106,400 electrons.
16. Calcium fluorid, composed of 145,000 electrons.
17. Carbohydrates, composed of 126,000 electrons.
18. Fats, composed of 159,600 electrons.
19. Proteids, composed of 11,959,500 electrons.

When a direct current is applied to the body, before electrolysis or dissociation takes place, millions of electrons or electrical units are set in motion, endeavoring to disentangle the electrons comprising the individual atoms from each group of atoms. When this is accomplished the freed ions pass in the direction of the path of least resistance. If it is the anions they pass on the direction of the lines of force or down stream, if the kations they pass in the opposite direction or up stream. These freed ions are influenced according to their polarity and pass in the direction of the path of least resistance. According to the writer's conception these electrons are electrical units having a plus and minus sign, and hitched up in closed chains and are keyed to a definite note, that note giving to the atom its color.

Before electrolysis can ensue it will be necessary to change the rythm of oscillation of the individual chains of electrons comprising the atoms, thereby freeing the ions, which pass in the direction of the least resistance or strongest electrical pull.

All changes in the tissue when electricity is applied are normally physiological; certain atoms or group of atoms comprising the tissue are influenced much more readily with a definite potential and rate of oscillation, while others are not apparently affected, and vice versa.

In electro therapy if you want to work miracles study your apparatus for varying the potentiality and oscillation of the various currents.



## The Medico-Legal Value of the Roentgen Rays.

BY MIHRAN K. KASSABIAN,  
PHILADELPHIA, PA.

That the skiagram, in forensic medicine, has distinct uses and value is a fact that has for some time been known both to the medical and legal professions. As time glides onward we shall observe that the skiagram, "the exact picture of the true state of affairs," will replace in the majority of accident cases the ordinary witnesses; the court and jury arriving at a decision either for plaintiff or defendant in less than half the time previously required.

During the past several years I have been privileged to produce skiagrams both for lawyers and physicians, and in quite a number of instances I have in connection with them given expert testimony. Especially is this true of the skiagram and confirmatory testimony in connection with railroad damage suits. As a result of this I feel that my experience has been more than sufficient to enable me to deliver a few remarks in this special line of work concerning the uses and value of the Röntgen rays in forensic medicine. Space and time will, unfortunately, not permit me to detail the interesting and puzzling cases for which I made skiagrams and delivered expert testimony, but what I can do will be to review a few facts and give several hints gleaned from experience, which may be of value in connection with this method of diagnosis.

That it is now considered advantageous to admit skiagraphic evidence into court is shown by the fact that the judges of advancing courts have permitted and even encouraged their use in addition to witness testimony in damage suits and even in other cases. This is true of all the courts in the eastern and middle states, with one or two exceptions. Judges, at-

torneys and jurists today do not care to have cases "hang on," but are very anxious to have all evidence handed in as soon as possible and the cases cleared up in as short a time as may be convenient. Photographs of accidents, convicts, etc., microscopic evidence, and many other scientific helps, are admitted into the various courts; why should the skiagram be excluded? Is there any reason for such rulings as were formerly made? Most decidedly not. There is not one fact offered today that is opposed to the uses of the skiagram in connection with court work—with, however, one condition, that it be produced by a person who is an expert in this line of work and not a novice.

The correctly produced skiagram is reliable, and when so produced can only illustrate the true state of affairs. It is, however, to be remembered that in order that a picture may be considered reliable, it must have been produced by a person who has had sufficient experience and as a result is skilled in the art of skiagraphy. The question as to who shall consider a skiagram as reliable evidence can in court only be decided by a person who is an expert in this particular work. A short time ago I was called as expert witness in a damage case against a railroad company and the question of a skiagram's reliability can best be illustrated by stating the facts of the case in question. Mr. H—— met with an accident and as a result brought suit against the railroad company, the plaintiff claiming heavy damages as a result of long-continued suffering and annoyance. The defendant company requested me to make a "picture" (skiagram) of the plaintiff's case, which the latter refused to permit, whereupon



the former would have made settlement. The plaintiff, however, had a skiagram made and was under the impression that he was in perfect readiness to battle with the defendant's x-ray expert. The case arrived at court and the facts laid before the jury and the judge by both sides. The plaintiff's skiagram was admitted as evidence by the judge into the court, and upon careful examination by me I decided that the photograph was unreliable in all respects. In the first place it had been made by a person who was not a physician (his occupation being salesman of x-ray instruments), at the same time the party in question had no experience in x-ray work (he having made only about a dozen attempts at skiagraphing various parts of the human body), a fact which he early admitted while on the witness stand. These facts alone would have rendered the photograph unreliable, but what is perhaps of more importance, dark lines were pointed out by the plaintiff's surgeon as "fracture lines"—at this time being "lines of callus," as he claimed. The "experts" in question had never seen four spine cases, which I made them admit when my time on the witness stand had come. What he claimed to be a shadow of callus I proved to the judge, attorneys and jurymen to be nothing more than the shadow of a spinous process—in fact the picture on very close examination showed five or six such supposed "fracture lines" which were nothing more than the shadows cast by the spinous processes of the respective vertebrae. This thus illustrates the fact that a skiagram may be unreliable, and should never be permitted to be entered as testimony until passed upon by a person whose expert competence is generally known.

From the foregoing points it may be observed that a skiagram in medico-legal cases is practically of no authoritative

value unless it has been produced by an expert. Again, it is very largely useless unless its value and exactitude are explained by either a surgeon or physician to the court. Its correctness can only be certified to by a person who is no other than an x-ray expert. The better way is for the expert who produced the skiagram to do the expert testifying, and never should an expert witness testify to a skiagram that has been made by an electrician or other non-medical man.

The value of a skiagram in medico-legal cases may be subdivided into the following headings: (1) The relation of a skiagram to the physician in making his diagnosis is of the utmost importance. A correct skiagram gives a proper diagnosis so that the attending physician or surgeon can treat said case or cases intelligently from the very beginning; the progress of reparation or cure can also be closely watched as time advances, so that the professional man can save himself from malpractice suits. I earnestly urge every physician to early have a skiagram taken of an accident, or other case, i. e. before any treatment has been resorted to, and a second skiagram after treatment has been instituted. Such records will protect the attending physician against any attempts at suits for damages in or out of court.

(2) The value of a properly taken skiagram to the judge, attorneys and jurymen is indeed so great as to leave the proceedings of an accident damage suit in darkness when no such evidence can be submitted. The time of such suit is greatly lengthened without such and, besides the expenses of the court are increased as such a suit "hangs on," a state of affairs that can be diminished when the time of trial is shortened as much as possible. When discussing the nature of an accident case, of necessity terms must be used which are of no mean-

ing to the usual run of jurymen, and in some cases to judges and attorneys. So when something tangible, as a skiagram, for instance, is submitted the jurymen, etc., will more readily understand and in the majority of cases the time of trial will be materially shortened.

The Röntgen rays show all kinds of fractures, no matter where located, with one or two exceptions, they being the base of the skull and fractures of certain portions of the vertebrae. The presence of a fracture can most decidedly be revealed in all other parts of the human body. Today we can show the exact structure of the bones, ligaments and tendons by means of the x-rays, and when fractures are present and are not reported by the skiagrapher, incompetence can be proclaimed.

Callus formation is in the majority of instances visible in the healing of a fracture, especially so when a proper technique is employed. The time necessary for the formation of callus depends upon the seat of the fracture, upon the age of the patient, upon his health, mode of treatment, etc. At any rate the repair of a fracture can be watched by the frequent production of skiagrams of the injured seat. An old fracture can be determined by the presence of callus, also a skiagram will reveal the fact whether or no the union is firm or false—whether the fracture has been united or not. By this means an epiphyseal separation may also be differentiated from an ordinary fracture, the former being more serious than the latter, thus affording more room for legal entanglements.

*Dislocations* can only be absolutely correctly diagnosed in early stages by means of the x-rays, the difficulty so experienced being due to excessive swelling, pain when examining by ordinary means, etc. When complicated by fracture a skiagram will be the only means of an absolutely correct

diagnosis. Reduction of dislocation as also of fracture can only be confirmed by this means of examination.

*Foreign Bodies*—These often remain undiagnosed, subsequently causing serious involvements. Thus when ascertained by this means dangerous probing has been avoided and the liability to infection has become nil.

*Diseases of Bones* are only diagnosed with absolute certainty by means of the x-rays.

*Diseases of Heart and Lungs*.—Certain diseases of these organs can only be diagnosed absolutely by means of the x-rays. Thus in a case of enlarged glands which gave rise to aphonia it was proved that there was no destruction of the true vocal cord, as the opposing side in a legal controversy had claimed.

*Deformities*.—The majority of legal cases belong to this class. The skiagram of fluoroscope reveals the actual degree of deformity of the osseous structures. If careful technic is employed there will be no resulting distortion or exaggeration of the true state of affairs. The question is often asked, "Could deformity have been avoided?" The answer to this may be as follows: The deformity is perhaps due to the fact that the physician did not know how to diagnose, and as a result properly treat, the case, and the deformity may have been due to the patient disobeying orders given by the surgeon or physician. Deformities in some instances will result no matter what care the physician and patient may take; in such cases it is always advisable to so inform the patient as early as possible. The attending physician, if afterward the latest, up-to-date, improved treatment has been employed, may be found by court to not be liable.

*Functional Disability*.—This does not bear a definite relation with the degree of

deformity, as in certain cases there is great deformity with little or no functional disability and vice versa. The important feature to be considered is whether or no the disability is temporary or permanent; if ankylosed is it true or false? The x-rays here again are the only means whereby an absolutely correct diagnosis can be made and an answer offered to the above.

#### POINTS ON THE TECHNIQUE OF MEDICO-LEGAL SKIAGRAPHY.

The technique in these cases does not vary greatly from that in any x-ray examination, except that especial care should be taken to have good, clear negatives. It is most important to have a detailed report of the case, as to the time after the accident, course of treatment, and physical signs of the accident. Examine carefully first with the closed fluoroscope, in a darkened room, so that the patient himself, or his attendants, may not see the result of the examination. Place the plate in position, in the presence of witnesses, and have a distinguishing mark upon it, such as a key or ring, for purpose of identification. Keep record of such details as the *time* of exposure, distance of the Crookes tube, position of the tube and part, etc. Take negatives from different points of view, and if possible take the injured and normal parts upon the same plate, for the purpose of comparison.

#### INTERPRETATION.

Now study the negative, provided it is satisfactory as to technique. Compare with previous negatives you have taken of the same part of the body and also with the corresponding normal part of the same person, being careful, however, to ascertain whether the supposed normal part has ever been the seat of a fracture. Print several copies, light and dark, so you can choose the print that shows the

condition the clearer. Write on the negative the names of the bones and try to make the picture intelligible to any one who examines it. Also make a tracing on the card, which will facilitate a proper understanding of the picture to untrained eyes. Having now made a positive diagnosis, write your expert diagnosis in a clear manner. An x-ray diagnosis will carry more weight in court if made by a physician, than if made by a man who is merely a photographer or a manufacturer of x-ray apparatus.

When called to court as an expert witness in a medico-legal case, it is important for the x-ray diagnostician to prepare himself carefully on the anatomy and pathology of the parts, to take with him negatives and prints of his x-ray examination, together with a set of bones of the part under consideration. When on the witness stand, he should be careful and accurate as to his statements, remembering the opposing party may also have an expert witness who would be likely to dispute his statements.

I can not do better in conclusion than quote the sensible, manly advice given by Sir William Blizard, of London. He says, "Be the plainest of men in the world in a court of justice. Never harbor a thought that if you do not appear positive you must appear little and mean. Give your evidence in as concise, plain and yet clear a manner as possible. Be intelligent, candid and just, but never aim at appearing unnecessarily scientific. State all the sources from and by which you have gained your information. If you can, make your evidence a self-evident truth. Thus, tho the court may at the time have a mean opinion of your judgment, they must deem you an honest man. Never be dogmatic or set yourself up for judge or jury. Take no side whatever but be impartial and you will be honest."



In conclusion again, I desire to say that I am of the belief that this distinguished body realizes the importance of x-rays in forensic medicine, having already been of great aid in diagnosing and deciding complicated legal cases appearing before the courts.

By hearty co-operation of both the legal and medical men in the future, the x-ray diagnoses will furnish the most scientific and unerring evidence in obscure cases.

#### **A Novel System of Wireless Telegraphy.**

Last year some beautiful experiments in wireless telephony were made by Herr E. Ruhmer on the Wannsee Lake, near Berlin, which were continued with increasing success in the course of the summer. Now the inventor has applied his process to optical telegraphy, and the Siemens & Schuckert Works are just now bringing out these novel wireless telegraph apparatus.

In optical telegraphy the rays issuing from a projector are, as a rule, intercepted at given intervals so as to form luminous flashes, succeeding one another more or less rapidly. In the Ruhmer telegraph system, on the contrary, the so-called speaking arcs are utilized by superposing on the continuous current circuit of the lamp placed at the sending station in the focus of a projector, a continuous current rapidly broken by means of a mechanical interrupter, the opening and closing being performed by a Morse key in accordance with ordinary Morse signals. At each closing of the telegraph key the superposed and frequently interrupted continuous current will modify the luminous intensity emanating from the electric arc, giving rise to luminous oscillations which are projected toward the receiving station. If all the conditions be so arranged that the luminous intensity of the lamp is

maintained constant, this process will ensure not only a more rapid handling of telegrams, but will permit, at the same time, of keeping the latter strictly secret, as the human eye, incapable of discerning more than ten luminous alternations per second, will get the impression of a continuous beam, on account of the rapidity with which the luminous oscillations of the transmitting station will succeed each other.

The receiving station is arranged in a way analogous to those of optical telephony, comprising two telephones and one parabolic reflector, in the focus of which the selenium cell is placed. The luminous oscillations of the transmitting station are perceived in the telephone of the receiving station by means of the selenium cell as humming intermittent sounds, constituting acoustical and directly perceived Morse signals. The pitch of the sound will depend on the frequency of the interrupter. Whereas in transmitting speech uncertainties are possible on account of the different acoustical intensities of the different vowels, the same sounds are heard here for more or less prolonged intervals. It has, therefore, been possible to ensure perfectly clear transmissions of signals in atmospheric conditions which would have rendered difficult the transmission of speech. The beginning of a communication is indicated by a bell, operated by the selenium cell without the agency of any wire connecting it with the transmitting station.

The satisfactory results of the experiments so far made go to show that this system of optical telegraphy, like the analogous system of optical telephony, will be used to special advantage in the case of transmissions over brief distances. It will, therefore, be especially suitable for military and naval purposes.—*Electrical Review*.



# Dangers to the X-Ray Operator.\*

BY JOHN T. PITKIN, M. D.

BUFFALO, N. Y.

(Continued from page 11)

The outside of such tubes becomes rapidly covered with dust and carbon, they are enveloped in a strong high-tension magnetic field which electrically charges all objects in the neighborhood; such tubes emit rays of an extreme degree of penetration. The relative danger of these tubes will change when we have stronger exciting apparatus. The latent capacity of the softer tubes has (probably) as yet never been utilized. The length of spark a given tube can back up is not mentioned, because the solidity and thickness of a spark are more essential to the efficient operation of a tube than its length—at least this has been my experience.

## CHAPTER II.

For purposes of study let us divide the action of the rays of Roentgen upon the operator into four arbitrary stages.

(1) Preparatory stage, or stage of first impressions.

(2) Premonitory, or threatening stage.

(3) Stage of inflammation and disintegration.

(4) Stage of chronic skin diseases, etc.

*Preparatory Stage*, or stage of first impressions.—As you are all well aware, the operator receives no warning from the tube, experiences no sensations while being injured. After a time there is a little change of color of his hands and face, which he may erroneously attribute to the action of the solar rays.

"His face is like the tan."

A few papules or pustules, with itching here and there, or bran-like scales, appar-

ently a local skin trouble (prurigo, acne or pruritus), a little swelling of the hands and features from circulatory disturbance, the falling out of his hair, attributed to senility, when in reality these are caused by the Roentgen rays, which are rendering the integument more and more susceptible to their action. Such symptoms should be looked upon as harbingers of an impending storm.

During a long period of increasing susceptibility the operator may imagine himself an x-ray immune, as if by some special dispensation he, like Shadrach, Meshack and Abednego, can walk in the fiery furnace (of the x-ray field) and not be burned.

*Premonitory or Threatening Stage.*—

The symptoms of this stage are itching, warmth, local diaphoresis, a mild seborrhea, partial anesthesia, luxuriant or deciduous hair (in hirsute people the shedding of the hair may be the first indication of the rays' effects), cutis anserina (goose skin), very small shot-like bodies in the cuticle, a glossy appearance of the parts as if they had been varnished, edematous swelling of the subcutaneous cellular tissue, causing the hands and face to become puffy, as they do in Bright's disease, rendering the fingers and palm of the hand stiff and awkward, effacing anatomical markings, and giving a general rotundity of contour. Punctate red spots, few and scattered (discrete) or many and close together (confluent), in groups, or patches diffuse; some are raised, others on a level with the surface. They may cause the skin to become as rough as the surface of a nutmeg grater. Some of the minute elevations may be colorless, and can be best seen by looking at the parts

\*Read before the American Roentgen Ray Society, University of Pa., Dec. 9, 10, 1903.

obliquely; they can also be discerned by careful palpation; there is a flushed look to the skin about them.

Discoloration of the skin may be red, reddish blue, yellow, brown, or black. The first two colors may or may not disappear; the others always remain, on pressure. Pigmented portions of the body are especially affected by pigmentation. The same is true of very dark individuals.

It is by keeping diseased parts of the patients who have malignant ailments in this stage of irritability, edema, tanning, or redness, and partial anesthesia, that the greatest number of cures can be effected. From this stage the operator may recover, with or without desquamation. (Exclusion of all forms of actinic rays, a good sweating of the parts, and crowding all the other enuncitories will help to restore the parts.) Otherwise, as the result of further exposure an operation or an accident such as a cut or blow to the irritated parts, the process will slowly and insidiously merge into the stage of chronic inflammation with its "cardinal signs, calor, dolor, ruber, tumor and functio lesae."

*Stage of Inflammation and Disintegration.*—The pathognomonic symptoms of x-ray inflammation, as experienced by myself after seven years' exposure in the x-ray field, were extreme itching, with constant desire to rub, scratch or dig into the affected parts. If the itching of the alleged seven years' itch could be crowded into a few months' time it would not be more aggravating. Eruptions, scarlatini-form rash, miliary papules, pustules and vesicles came in successive crops. They resulted from the more or less destructive inflammatory involvement of the follicles and their cellular elements. Like thorns in the flesh, or other foreign bodies, they were thrown off, leaving the skin honeycombed with small ulcers oozing a

hydro-serous discharge, alkaline in reaction. This discharge may be odorless or have a putrid smell, according to the severity of the process. Some of the hairs could be drawn from their pockets, as if they had been loosened by electrolysis.

Exfoliation of the skin; fifty, a hundred times, or more, the epidermis was thrown off in scales of various size, shape and consistency. In places slightly affected the desquamation was scarlatini-form, the disease painless. Where quite severe the scales were at first thick and macerated, pseudo-membranous. Late in the disease the scales became desiccated and appeared as they do in many forms of skin disease. If the scales were torn away the surface bled freely from the points of their attachment.

Inflammatory mounds; where the process is quite severe, but attacks circumscribed areas more severely than intervening spaces, inflammatory mounds appear capped with a white membranous patch. In time the patch breaks down, leaving a ragged-edged crater-like opening. A common position for these mounds is over the articular surfaces, but they may form upon the dorsum of the hand, the fingers, and in other localities.

Extensive ulceration; if the inflammatory process is severe, the eruptions, small ulcers and mounds all become confluent, the surface breaks down, forming ulcerated excavations with a raised border. Their central portion may be either naked or covered with a thick whitish pseudo-membrane. Under these conditions the suffering is intense, the discharge sanious and offensive.

Pain and Suffering.—For a description of the pain and suffering, hyperesthesia and paresthesia, no language, sacred or profane, is adequate. The sting of the honey-bee or the passage of a renal cal-

culus is painful enough but are comparative pleasures, because being paroxysmal they have a time limitation. There is extreme tenderness to the slightest touch; hot and cold waves and flashes, warmth, tingling, pricking, throbbing, stinging, crawling, boring and burning sensations, as if the parts were on fire and contained bugs and other living things, and as if the anatomical structures were being moved from one position to another. All of these sensations are proportionate to the depth of the inflammatory process.

All forms of radiant energy, light, heat, magnetism, ultra-violet rays, etc., increase the suffering. The parts are irritated by soap solutions or attempts to use them for any purpose. The suffering is also augmented if the affected members are allowed to become dependent, hence the afflicted operator holds his hands high above his head, even sleeping with them in that posture.

If the inflammation in his hands is severe, muscular action will be temporarily lost, the fingers immobile. He must be dressed, undressed, and fed by attendants.

Healing of the Parts.—There are abortive efforts of the parts to heal; they heal over only to break down again, or, healing in some places they break down in others. No healthy scabs form over the ulcers, no laudable pus, so-called, appears.

The formation of granulations and scar flesh is defective, consequently the processes of repair are indolent, ineffectual, requiring months to restore the parts.

Eventually the epithelial cells will spread from the margin and islet over the ulcerations, and the injured parts are thus supplied with a thin investment. Muscular power returns. Wherever the hair is restored, as it frequently is, it will return more vigorous.

Physiological rest, an elevated position, exclusion from all forms of actinic rays,

the burning away of deciduous material with dioxygen, the employment of formaldehyd, 10 per cent solution, as an antiseptic wash, and a thick dressing of equal parts of vaselin and powdered starch, evacuation of pustules, and the wearing of kid gloves for several months after the acuteness of the attack has passed, will afford considerable relief to the sufferer. Dr. Robinson, of Philadelphia, uses picric acid; Dr. Dunning, of the same city, employs the lead plaster.

I quote the following, illustrating an extreme degree of chronicity of x-ray inflammation, also showing how the operators who work with the most powerful apparatus and the greatest number of hours per day are usually the greatest sufferers:

"LONDON, August 6, 1903.—(Via Associated Press.)—Two doctors belonging to the London Hospital have been affected by x-rays in a manner similar to that of the assistant of Thomas A. Edison, and have been compelled to abandon their work. They were engaged for a long time in making examinations of and manipulating diseased parts while x-rays were directed on the patients.

"When they began to suffer they tried gloves, on the backs of which lead foil was sewn, but these impeded the movements of their hands and were discarded.

"One of the operators ceased operating under the rays eighteen months ago, yet his hands have improved little despite constant treatment."

To return to my own case, large red blotches and acne pustules appeared on my face and neck, with a burning sensation, followed in time by desquamation and restitution. The parts were left sensitive to light, heat, etc., which for a time caused them to redden and peel in furfuraceous scales. My left hand was much involved, hundreds of minute abscesses formed upon



the dorsum. The integument exfoliated many times. The nail of the ring finger came off, but was renewed. The nails of all the digits, except the thumb, became deformed, brittle and deficient in their usual luster. The shape of the hand was permanently changed, the rugae of the skin, the ridges on the nails, the knuckles and palmar arch are more prominent than they were formerly. Yawning caused muscular spasm of the fingers. Inflammatory mounds with their white caps and crater-like openings came and went in the usual dilatory manner.

Five months after the onset of the attack the parts had healed, but were so sensitive to the Roentgen rays that a fifteen seconds' exposure about one yard from the tube in a strong, high tension field caused a secondary dermatitis. The period of incubation, usually from one to two weeks, was reduced to as many days. The secondary dermatitis cleared up several large ugly patches of skin disease left from the primary attack. This shows that the x-light may in a measure prove to be a remedy for its own indolent process and sequela.

Eight months after the onset of the

primary attack improvement slowly but surely continued in the newly formed skin, the atrophic changes remained the same but the hypertrophic changes had diminished. The skin was more tolerant of all forms of actinic rays. The vaselin and starch dressing was still employed at night, but the wearing of gloves during the daytime was no longer necessary.

In the primary attack the right hand was less severely affected than the left. Tenderness extended up both arms into the axilla. I suffered with malaise, daily chill and fever (mild), headache, sore throat (mild), nausea and vomiting (one attack, quite severe), vertigo (mild), and one attack of dyspnea (severe, but short), probably from cardiac impairment of function. There was a fine rash like that of typhoid fever scattered over the entire body.

Whether an attack of erysipelas, sustained in both hands about twelve years previous, predisposed me to x-ray inflammation, modified its course or prevented cancerous sequela, I am unable to determine; certain it is, the two diseases (x-ray dermatitis and erysipelas) have many symptoms in common.



Mild Case of X-Ray Dermatitis, showing scarlatiniform desquamation and pigmentation.  
(Cut loaned by Dr. Pratt.)



# Electro Therapy.

A Course of Twenty-four Lessons under the auspices of the Chicago College of X-Ray and Electro Therapeutics.

## Lesson 9—STATIC CURRENTS.

A static machine may be used to obtain either direct or alternating currents. The direct current is obtained from the large brass balls (prime conductors) in front of the machine. The circuit extends from one of the prime conductors by means of an insulated brass rod to the collecting points on the inside of the glass case, from which the charge is carried on the surfaces of the rotating disks to the other collecting points, and thence to the second brass ball. Between the prime conductors the circuit is completed by the sliding discharging rods when these are in contact, or partly by them and partly by the air.

The direction of the current may be inferred from the appearance of the spark between the discharging rods or at any other place at which there is an air gap in the circuit. If the two small brass balls are well polished and are a very little distance apart there is between them a violet streak of light with a distinct white streak at each end of it. At the anode or the positive pole the white streak is longer than the other, or the positive current passes from the longer to the shorter white streak.

As the rods are drawn still further apart there comes a point at which the whiteness extends clear across between the balls. The current at this stage is oscillating; that is to say, each impulse of the current is followed by rapid and rapidly diminishing alternations of the current. This current has polarity, but its direction can not be detected by the eye alone.

When the rods are drawn still further apart the character of the spark again changes. It is now a bluish white or violet zigzag line, starting out from the anode in a perfectly straight line for a

centimeter, more or less, then making angles, and at the angles giving off fainter bluish tree-like branches. Further on the line may become hazy, or may disappear, but it soon re-collects and forms a solid and much whiter streak, which continues nearly, but not quite, up to the kathode.

If the point of a stick be placed in the path of the spark and close to the anode, the current seems to prefer the stick to the air for a pathway, and will follow the stick for some distance when the point is moved across its path. At the kathode the current pays very little attention to the stick. In this way the direction of the current may be known even in the oscillating stage. The oscillating current is really the sum of a direct and an alternating current.

When a wire, a chain, or any other conductor is connected with one of the prime conductors, and another wire to the other prime conductor, these wires become part of the circuit and the spark may be obtained by bringing their extremities near together. The principle is exactly the same if a gaspipe or the ground takes the place of one of the wires. A great deal of what is said and written about "grounding" one of the poles of a static machine is nonsense.

When there is an air gap in the circuit, of such a character that sparks are visible, the static current is always intermittent. The current becomes continuous, or nearly so, when the circuit outside of the machine is entirely metallic, or when there is a gap bordered by one or more metallic points. The amperage of such a current depends upon several factors: the number and size of the revolving plates, their arrangement, their speed, the electro-motive

force the machine can maintain, leakage at various points, and, lastly, the resistance of the outer part of the circuit. Of these factors the only ones that are under the control of the operator with a given machine are the speed of the plates and the resistance of the outer circuit. Under favorable conditions a good static machine gives nearly one milliampere of current. The current is diminished in proportion with a diminution of the speed of the machine. The current is also diminished in proportion to the resistance of the circuit. These remarks apply to the current only when it is continuous or nearly so, and are only approximately true for the spark discharges.

The relative amount of current in the sparks may be inferred from their appearance. A spark whose current is small looks thin and blue or violet, and has a strong tendency to split or branch. When the current in each spark is greater the spark is thicker and whiter and is more likely to form a single streak.

The alternating current is obtained from the static machine by means of the Leyden jar condensers. One of these is usually placed on each end of the shelf in front of the machine. The brass knob of the jar, which is in metallic connection with its inner coat of tinfoil, is connected with the nearest prime conductor. Its outer coat is usually connected to a binding post on the same shelf. To these two binding posts the wires of the electrodes are connected for treatment. This secondary circuit, in which the two Leyden jars are included, is sometimes referred to as the induced circuit. It includes the prime conductors and their discharging rods, with the air gap between them. The Leyden jars and the conductors extending between their outer surfaces complete the circuit.

The electro-motive force of the sec-

ondary circuit is produced by the changes in the potential of the prime conductors when sparks are passing across the air gap. When a spark begins, the resistance of the air gap suddenly drops to nearly zero. The potential of the prime conductors also becomes zero, but immediately rises on account of the accumulating charges due to the continued rotation of the plates. When the potential has become so great as to produce another spark it again drops, and so on. When the potential is high, say upon the positive pole, a right-handed twist extends thru the glass of the Leyden jar and into the lower part of the circuit. At the same time a left-handed twist extends thru the glass of the other Leyden jar into the lower part of the same circuit, there reinforcing the first. When the potential drops, the elasticity of the glass causes a reversed turn of these atomic chains. The first turn being considered positive, its reversal constitutes a negative current. When the alternations of the current thus induced in the secondary circuit are very rapid the current is nearly sinusoidal. When the sparks are less frequent, the electro-motive force of the prime conductors rises slowly and drops suddenly. The first induced current (positive) has, therefore, much less electro-motive force, but longer duration than the second. Under these conditions, if a spark gap of sufficient size be made in the lower part of the secondary circuit it may be so adjusted that the positive current fails to pass while the negative (reverse) current succeeds. In this case the current in the secondary circuit is direct, that is to say, in one direction only.

When the resistance in the secondary circuit is small in relation to the capacity of the condensers, the current velocity during the reversal becomes so great that the elastic atoms in the glass are turned

beyond the point of equilibrium and are twisted in the opposite direction. Their return produces a second positive current, which again may swing too far and give rise to a second negative current, etc. In such a case we have in this circuit an oscillating current resembling in char-

acter the more rapid high frequency current.

These are all the currents which it is possible to obtain from an ordinary static machine without the use of additional apparatus. Their applications will be described in the next lesson.

## Two Cases of Severe X-Ray Necrosis, Presenting Some Unusual Features.

BY CLARENCE EDWARD SKINNER, M. D., LL. D., NEW HAVEN, CONN.

Read at the fourth annual convention of the American Roentgen Ray Society, at Philadelphia, Pa., December 9, 1903.

The unusual features about the first case were:

First, that the necrosis extended to a depth of three-quarters of an inch by actual measurement, and covered a surface four inches in the vertical by eight in the lateral diameter.

Second, the epithelial layer covering the contiguous apparently healthy areas peeled off two months after the last x-ray exposure, leaving soft, pink, healthy epithelium in its place. In the course of three weeks this skin had become as deeply browned as that which had peeled off, altho no exposure to the rays had been made in the meantime.

Third, the pain ceased when the necrotic tissue had completely sloughed.

Fourth, the negative pole of the galvanic current was used with satisfactory results in accelerating the process of healing.

Fifth, an area of necrosis appeared five months after the last x-ray application in a region which had previously exhibited no evidence that any injury had been inflicted.

Sixth, a dusting powder, consisting of equal parts of anesthesine and talc was

entirely effective in controlling the pain in the last mentioned area of ulceration.

The noticeable features in the second case were:

First, that subcutaneous effusions of blood appeared in about two weeks in advance of necrosis in all the tissues which were affected.

Second, profound erythema and structural modification appeared spontaneously in the newly formed skin, covering the apparently healthy areas contiguous to the necrotic localities, and which had been exposed by the exfoliation of that which had been browned by the direct agency of the rays, altho this new skin had not been exposed to the ray.

Third, the pain ceased as soon as the necrotic tissue had completely separated.

Fourth, the negative pole of the galvanic battery produced apparently no effect as far as accelerating the separation of the slough was concerned, but its beneficial influence upon the reparative process was very noticeable after the tissue had sloughed.

Fifth, an area of necrosis appeared six months after the last x-ray application in a region which had previously indicated



no evidence that such injury had taken place.

Sixth, the anesthetic and talc mixture referred to in connection with the previous case aggravated the pain when used in Case 2.

Dr. Skinner states the conclusions which draws from these cases to be as follows:

First, the belief somewhat extensively held that a patient who "tans" well need not fear a burn is demonstrated to be untenable. Both of these patients tanned readily and profoundly.

Second, the "tanning" and excessive epithelial proliferation of the new skin observed in Case 1, and the profound erythema and structural changes of the new skin observed in Case 2, all of which modifications obtained in tissues which had developed months after exposures to the rays had ceased, indicate that the physiological action of x-light is not confined to stimulant or destructive influence upon tissues that already exist, but that it is capable of modifying most profoundly and more or less permanently the developmental functions which control cell growth. It is believed that this phase of influence will be ascertained ultimately to play no small part in the beneficial effect exerted by the x-ray upon many cases of malignant growth.

Third, the abrupt cessation of the sharp, cutting pains simultaneously with the final separation of the necrotic tissue would point to direct irritation by the sloughing mass of the distal ends of nerve trunks supplying the affected parts as their exciting cause, probably thru the development of toxins by retrograde tissue metamorphosis at the line of separation; a neuralgia, in short, and which would indicate extirpation of the necrotic area by curettement or otherwise as a log-

ical management for x-ray dermatitis of this degree.

Fourth, the accelerating influence of the direct electrical current upon the process of healing after the slough had separated, noted in both cases, is significant from a therapeutical standpoint. The power of the negative pole of the direct electrical current to hasten repair in open sores of various sorts has long been known to electro-therapeutists, but the x-ray ulceration has exhibited a peculiarly intense resistance to all ordinary measures available for this purpose, and the knowledge that we have in this modality an effective curative agent even in this condition constitutes a comforting fact. It is probable that skin grafting will be avoidable in many cases where galvanism is available.

Fifth, the appearance of new areas of necrosis in Case 1, five months, and in Case 2, six months, after the last x-ray exposure had been made, admits of three hypotheses in the way of explanation. It might have been due to a cumulative characteristic of the ray, whereby the direct effect of the exposure did not fully develop until after these lapses of time; it may have been due to a modifying influence exerted by the ray upon the developmental functions of the cells involved, whereby the younger generations of cells were unable to acquire the degree of vitality necessary for the maintenance of tissue integrity; or it may have been the indirect result of circulatory insufficiency caused by an x-ray endarteritis obliterans which had required this length of time for its full development. None of these are entirely satisfactory, however, and we shall have to await the acquisition of a fuller knowledge of the *modus operandi* of x-ray effects before we can decisively account for this and many other of its vagaries.



Sixth, the sedative effect of anesthesine upon the pain in Case 1, and its aggravating influence in Case 2, illustrates the statement frequently made, and the truth of which is now pretty generally admitted, that no two cases of x-ray pain can be depended upon to react uniformly to the same palliative agents. In no other condition does there obtain so emphatic an exemplification of the old adage that "What's one man's meat is another man's poison." Each case must be treated on its own individual peculiarities, and usually the only way to ascertain the peculiarities is to begin at one end of the list of therapeutical agencies and apply them successively until we find one that is effective.

Seventh, the sudden and constant appearance of subcutaneous hemorrhage preceding the development of necrosis noted in Case 2 is worthy of record, but I do not at present comprehend its significance, nor can I offer a satisfactory explanation.

The histories of these two cases constitute a warning against exposing a patient to the x-rays with even a moderate degree of frequency thru long periods of time, no matter how well they seem to bear them at first. There are few conditions so pregnant with torture for the victim as a deep x-ray dermatitis, and the risk of precipitating such a disaster is only justifiable in cases presenting an absolutely hopeless prognosis under other methods of treatment.

## Notes.

Dr. H. Preston Pratt has just returned from a trip to the Atlantic Coast. He has secured a specimen of radium of high radio activity for use in his x-ray laboratory. He has also investigated the latest forms of x-ray and electro-therapeutic apparatus, Finsen light, etc.

**Electrical Typewriters.**—The Blickensderfer Typewriter Company, of Newcastle-on-Tyne, is placing on the market an electrical typewriter. At the back of, and embodied in, the machine is a small motor which provides the printing power; the slightest touch of the key is sufficient to make the impression by electrical force the instant the operator's fingers complete the contact by touching the keys.

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If any of our readers can supply one or more copies of the X-Ray Journal for December 1902, and January and February 1903, we shall be very glad to purchase them.



## Suggestion in its Relation to Electrical Appliances.\*

BY CHARLES GILBERT DAVIS, M. D., CHICAGO.

The egotism of the age in which we live is monstrous. In our youth we read from the pages of holy writ: "The wisdom of this world is foolishness." It seems to me, in taking a panoramic view of human knowledge as presented to us today, it would have been far better had this truth been more deeply impressed upon our understanding.

For how little we know! Simply babes gathering pebbles on the shore, laughing at the waves making ripples in the sand, but of the great ocean that lies beyond knowing nothing.

For thousands of years philosophers have attempted to solve the mystery of life, but the great secret remains concealed. And now in the dawn of the twentieth century, after sifting the accumulated thought of all the generations that have passed, psychologists, biologists and eminent scientists tell us there are but two things in existence, i. e., force and consciousness.

Thru the process of growth which we term evolution, consciousness has pushed itself upward and outward, gradually enlarging its recognition of the physical universe, and thru desire and auto-suggestion developed certain organs of special sense, i. e., hearing, seeing, smelling, tasting and feeling; and perhaps others are to be added later.

The highest expression of consciousness we find on our own planet is man. Reasoning from analogy I should say that man in his present condition is by no means the highest expression of conscious life. In all probability he is only an illustration of an epoch which may be followed by innumerable stages of develop-

ment continuing thru millions of years, till ultimately the conscious ego shall stand radiant with perfection, and all knowledge be intuitive. But in wisdom he is still a child.

Thru these five windows—hearing, seeing, smelling, tasting and feeling—the conscious ego looks out upon the surrounding universe. They are all that connect him consciously with physical life. Thru these windows he receives communications, and this is suggestion. Then in the crucible of his own consciousness he meditates upon the impressions received, exercises the will and expresses desire, and this is auto-suggestion.

Thru these two channels, suggestion and auto-suggestion, man has groped his way upward from the elemental protoplasm, the "unicellular organism" and the more complex forms of animal existence. Step by step it has conducted him thru savagery, the cave life of the past, the awful darkness of superstition and ignorance, and led him gently and surely into the radiant light of conscious power that crowns him in the present age.

The same law that guided the first primordial cell is still in operation. The horizon of consciousness is ever widening and deepening in its scope of power, and mind is assuming its rightful mastery over matter.

Man is still receiving messages thru these five windows of the soul, and in the crucible of his inner consciousness elaborating ideals which he projects before his vision to guide him to greater heights.

In animal life, and exemplified in its highest degree in man, we find the mind manifesting itself on two planes: First, the conscious mind, whose organ is the

\*Read at the first annual meeting of the American Electro-Medical Society, at Chicago, Dec. 2-3, 1903.

cerebrospinal nervous system. Second, the sub-conscious mind which operates thru the sympathetic nervous system.

The first or conscious mind receives the impressions from the surrounding universe, thru these five windows of communication deliberates, is mathematical, logical, reasons, arrives at conclusions and telegraphs the result thru the connecting nerves to the ganglia of the sympathetic, and there impresses the sub-conscious life; and consequently reacts beneficially or otherwise on the various organs.

The second, or sub-conscious mind, presides over nutrition, receives the communications from the laboratory of consciousness, never reasons, but acts automatically thru emotion, feeling, desire and impulse. It is, in fact, the location of the real man. In this center is to be found the measure of viability. I have often remarked that had I the opportunity to manufacture a man's stomach I would not care who made his brain—he would still be a man.

The most interesting point relating to these two centers is that the subconscious mind is always open to suggestion from the conscious. I regard this subject as one of the greatest importance that can possibly occupy the mind of the medical profession today. I believe it was St. Paul who said: "As a man thinketh, so is he." This contains the germ of much truth. The influence of the sub-conscious mind over the nutrition of the system has for ages attracted the attention of thinking men, but never has it been under such widespread discussion as within the last few years.

Turn in what ever direction we may, we find illustrations. We note the effect of nutrition in the victory and defeat of armies, the rise and fall of political parties, the teachings of religion, the wild utterances of fanatical leaders, and nowhere

is it more vividly portrayed than in the healing art.

In reference to this question said that great American teacher, Austin Flint, more than forty years ago: "Gentlemen, there is something in the practice of medicine far beyond the mere administration of drugs."

Every modern successful physician knows the necessity of arousing the subtle forces of the sub-conscious mind. I would not hesitate today to proclaim before any medical convention in the world that I believe that faith, hope, expectancy and belief in many instances are the most useful and the most powerful therapeutic agents of the age in which we live.

I am a scientist and advocate the thoro pursuit of all knowledge that may be beneficial to mankind, no matter from whence it comes—whether from the beds of slime and ooze in the depths of the sea, or a ray of light vibrating thru the blue ether from the farthest fixed star. I am also convinced that often in the attempt to follow the mysterious vaporings of some scientific theory we lose sight of truth. They are not a few, but the world today has millions of illustrations of the truth of that utterance: "Thy faith hath made thee whole."

We as doctors too frequently deny this. While the patients were under our care we were willing to say they were quite ill and accept our fees for valuable services, but when they pronounced themselves fully restored to health by other means, we were inclined to doubt the presence of disease.

As true scientists we must admit, with all evidence of the ages before us, that this subjective mind is most potent both to create and remove disease. If we only observe, there is scarcely an hour of the day but we are enabled to behold the verification of this truth.



Sometime ago I saw a man rosy with health and strength, full of the joy of life, and laughter in his eyes, sitting at dinner with his friends. He was at the zenith of manhood, and the life currents flowed thru his being like a stream of pure water thru a sunlit meadow. The emotions from his spirit made glad the festal board. Suddenly a messenger entered and handed him a telegram: "Your home was swept away by the flood, and your wife and children drowned."

Like a stroke from a bolt of lightning, the effect was instantaneous. The eyes read again and again the fatal words, the message was conveyed along the optic tracts to the seat of consciousness and from there to the center of life in the subconscious mind, and the machinery of nature stood still. Every cell of the entire organism vibrated under the awful blow. All over the surface of the body the little arterioles shriveled and contracted, producing a deathly pallor, and the red globules of blood that had before been hurrying on their mission of health, were crowded back and looked up in the deep reservoirs of the system. The arms fell powerless, the muscles relaxed, hard lines were formed around the mouth, the cheeks were sunken, the eyeballs from lack of secretion were glazed, respiration was irregular and the heart almost ceased to beat. He was ill.

About twenty-four hours later I was summoned with the request to hurry. I found him dangerously ill. He was partially delirious, the face I had seen the day before glorified with health was shrunken, the eyes jaundiced, showing that the bile was being re-absorbed into the circulation, the lips were dry and breath fetid. He had vomited several times, throwing off from the stomach the food that had been abandoned by the gastric juice. This state of the mouth and the intestinal canal showed clearly that pathological

bacteria were now at work seeking the man's life.

Now supposing a consultation of doctors, without being acquainted with the incidents of the last twenty-four hours could have been called to decide as to this man's condition and the remedy, what would have been the verdict?

In St. Louis it would have been malaria, and large doses of quinin; in New York, gastro-enteritis, complicated with cholelithiasis and renal insufficiency, with large doses of calomel; in Chicago, immediate appendectomy.

The cause of the man's illness would have been attributed to taking cold, overwork, ptomain poisoning, champagne, or eating grape seeds. The truth of the matter is he was made ill by his mind. A thought was killing him. A suggestion had entered by one of the windows and was working destruction, threatening life.

This continued for twenty-four hours longer, and then another telegram arrived:

"Your house not destroyed—your wife and children all safe and well."

It was read to him, and slowly thru the auditory nerve the glad tidings were transmitted to the brain and from there to the subconscious centers. The arteries relaxed, the blood freighted with red corpuscles flowed thru the capillaries, and the deadly pallor was replaced by the returning hue of health. The eye brightened, the muscles renewed their vigor, and the man stood erect with glowing face.

That night he again sat at the banquet board surrounded by his family and friends, and entertained them with his overflow of vital force.

This man was made ill by a depressing thought, and he was near unto death; this man was cured by a hopeful thought. Will any one doubt the wonderful power mind wields over the body? Every thought we



think, every hope we breathe, every faith that sweeps thru the chambers of the mind, has its mathematical effect on every cell in the human organism.

An old lady came to me from Indiana. She had malaria. I gave her quinin and ferroconid of iron, in capsules. Of course the capsules were of a very blue color. In one week she returned. As soon as she entered my consultation room I saw that she had fight in her eyes, and she opened up on me the artillery of her wrath:

"Begorra! dochter, what fur did ye iver give me that horrid blue mass? It is silivated to dith I am, I am shure!"

She showed me her mouth, and sure enough, so far as local evidence could prove, she had a case of well marked pytalism. Some years before she had been given blue-mass by a physieian, and suffered for several weeks from severe salivation. She only took one of my capsules, and then, discovering that they were blue, jumped to the conclusion that, of course, they were blue-mass. Suggestion did the rest. She was sure she had swallowed a big dose of blue-mass—she expected salivation to follow, and it did.

It took all the genius of my forensic power to convince the old lady of her mistake, and I am not yet sure that I was successful, for she never returned.

Once while out of the city a lady patient of mine of neurotic temperament was taken ill. When I returned she sent for me. Her most marked symptom was insomnia. According to the statement of the nurse, she had not slept for three days and nights. Her table was covered with bottles of bromid, chloral and other hypnotic potions, to none of which had she yielded to receive a moment's sleep. Her tongue was coated and the skin sallow. Evidently the action of the liver was disturbed. I knew her temperament, and recognized the necessity of some form

of suggestion to remove the apparently fixed idea of her inability to sleep. At the same time I also felt that she required something to restore the action of the liver and arouse the intestinal canal to increased excretion.

I resolved to combine the two lines of treatment, and ordered for her one grain of calomel combined with three grains of bicarbonate of soda, saying impressively:

"You are undoubtedly very ill, and the urgency of the case requires something very powerful to meet the conditions. I have given you one small white powder which I am sure will do the work. As soon as this comes from the druggist take it on the tongue dry, followed by one tablespoonful of cold water. Then turn on your right side—be sure it is the right—count one hundred, and you will sleep soundly."

When I called the next day she met me with a smiling face. She had awakened from eight hours' slumber, and the bowels had moved, restoring completely the function of the abdominal viscera. This happened several years ago, but many times since then this patient has begged me the name of the wonderful little white powder that made her sleep, but I have always refused the request, intimating that it was too dangerous to be trusted for administration by other than skilled professional hands. In this case there are two ways of looking at the cause of the results obtained.

First—That it was all purely suggestion, and that the medicine had nothing to do with her cure.

Second—That the calomel and soda were just what she required to start the liver and other viscera into action, and the vis-a-tergo from this action restored the cerebral circulation, and sleep naturally followed.

In my own mind I am satisfied that

the prescription was rational, but I am also thoroly convinced that suggestion played the major part in her restoration. It will be observed in this case that all of my suggestions were made along the lines of scientific truth.

First—these two remedies were just what she required to unlock the viscera.

Second—I said the medicine was powerful, and so it is, in its manner of action.

Third—I told her to be sure and turn on her right side, for in this position the powder would the sooner pass from the stomach and hasten the flow of bile thru the intestinal canal.

Fourth—In directing her to count one hundred I established a rythm of concentrated thot that would be conducive to sleep.

So the *tout ensemble* was scientific, suggestive, powerful and successful.

Electricity usually flows best when it follows a good conductor, and so does suggestion. In this case the powder was the conductor that conveyed the suggestive impulse to the patient. I believe always that suggestion should be made along the lines of known scientific truth. In this way they are more potent. No man can long propagate a lie, and succeed. I do not believe in placeboes per se, they must always have *vera causa* relating to physical effects. In this way the physician believes himself in what he is doing, and can with confidence and power send the suggestive impulse to do its work. A liar shows the falsehood in his face, while truth is bold and convincing. Thrice assured is he who is armed with truth!

Certainly there is much more in the praetice of medicin than can be attributed to the action of drugs. Look at the *materia medica* of the world, and trace its history back for one or two thousand years. What a constant revolution of ideas! What wonderful panaceas have

arisen and then gone down in oblivion and been discarded as useless.

And yet somehow poor struggling humanity has managed to survive, and among all the nations, savage as well as civilized in about equal proportion, they have lived and died of old age. The yellow hordes of China's millions, the countless hosts of India, and the swarms of humanity on the deserts of Egypt, for thousands of years have manifested plethoric fecundity, multiplied, lived and manifested all the normal functions of life, ages before a single article of our *materia medica* was discovered, or such a thing as a bacillus or counteracting antiseptic entered into the wildest visions of the Orient.

We are growing too introspective, and introspection is bad, because it creates disease. We are arguing too much along the line of *post hoc ergo propter hoc*. Let us not pride ourselves on our knowledge, for I have not the slightest doubt but that in a hundred years from today our successors will stand upon this very spot and scream with laughter over our methods of combating disease.

Running continuously thru the healing art is the potent current of suggestion. It is everywhere. The mother's kiss and her soothing tones carry a suggestive calm to the subconscious life of the suffering infant, and it is soothed to rest.

The intelligent citizen enters the office of the prominent physician. His blood is examined under the microscope, his urine analysed, his stomach pumped out, and finally he is thumped in the ribs and given a prescription. He is fully convinced that he has met the quintessence of human wisdom, goes home and swallows his dope of bromid or strychnia, and feels the thrill of health capering up and down his spinal column. Tho he would deny it vehemently, the mysterious wand of suggestion has touched and thrilled the centers of

organic life. One of dozens of the different articles of our *materia medica* might have been administered to him, and equivalent results obtained.

It is wonderful with how few remedies we can practice medicine. We had a physician in Chicago whose prescriptions for more than twenty years were composed largely of carbolic acid, blue mass, jimson weed, and baking soda. And yet it is not unusual now for a good old Irish mother to entertain me by relating some severe illness of her younger days of which she was healed by one of these potent mixtures.

Faith, like electricity, must have a conductor. There must be a medium to touch one of the five senses. The eye must see, the ear hear, or the tongue taste, to awaken the suggestive power.

Humanity has not yet risen to the sublime altitude of development to enable it to evolve perfect faith from the inner consciousness.

Religion still requires the graven image, the lighted tapers and the chanting choir; and the patient rests his wavering hope on the powder and the pill.

We read in Holy Writ that Christ cured the blind man by making an ointment of spittle and clay and applying it to the eyes. Many undoubtedly discredit this miracle, but to me it seems most rational. What was required in the case was sufficient faith in the Great Physician. Adherents to the higher criticism, while admitting the miracle, would probably say that the man had only some inflammatory condition, and the clay with its silicious composition was just the medicine required to make a soothing ointment which would do the work. And then the saliva of course, it is bactericidal, and here we have a mixture which would satisfy the logical reasoning of the most advanced modern theologian. But to me the operation of faith, arousing the nutritive

forces of subconscious life, seems by far the better explanation. The man had feeble faith, and the ointment gave it support.

Without argument as to the actual occurrence of this miracle, we must admit it to be a splendid illustration of the *modus operandi* of suggestion.

But what has all of this to do with electrotherapeutics? Very much, indeed!

Whatever is new and mysterious and wonderful to man is God-like and in the imagination endowed with superhuman attributes. All therapeutic agents are capable of a two-fold action. First, we have what we may term the normal, direct or physical result of the active agent, whether it be a drug, electricity or the surgeon's knife.

Second, we have the psychic effect, whereby the normal action of the remedial agent, whether electricity, a medicine or a surgical operation, is perverted, altered, depressed or wonderfully exalted; dependent upon numberless conditions, as by whom or to whom directed, and in what environment.

This latter, the psychic. I regard of great importance and far-reaching possibilities, and should always be taken into account by the intelligent physician. The evanescent wave of this always follows the announcement of new discoveries in medicine and surgery, and the legitimacy of the healing art passes often then to the realms of quackery.

Looking backward over the history of medicine we smile at the announced efficacy of dragon's blood and dried toads, and again we blush that within our own memory, the profession and the public aroused such enthusiasm over phlebotomy, phenic acid injections, Candurango and Koeh's lymph, to say nothing of the abuse of appendectomy.

Of all therapeutic applications that are today employed in our profession, I know



of none in which we are more liable in judging of results to mistake sequences for consequences, than that of electricity. The greatest scientists of the age know but little about electricity. Our profession does not know a great deal, and the public still less.

It is natural, shrouded as it is in mystery, that in the mind its effects should be exalted. I well remember my first experience with electricity. It was about thirty years ago, and I purchased a Kidder's battery.

It seems to me when I look back at those days that I then obtained almost if not quite as wonderful effects as now when equipped with the complicated paraphernalia of electric appliances..

Then I scarcely knew one current from another, only that one was silent, and the other made a noise. I usually chose the noisy current, because it seemed to impress the patient that something was doing and he was getting the worth of his money.

It was not considered very ethical to use electricity in those days, consequently my conscience goaded me, and I kept the battery under the bed, so that my confreers could not discover it when they called.

But they finally found me out, and I was considered quite irregular, particularly so as my cases increased. The cures that I made were indeed wonderful, covering a wide range of cases from malaria to fits. But I finally drew the line when an old farmer who had heard of my wonderful machine drove up and wanted me to try it on his horse to cure the bots.

When I look back upon that period now I fully recognize the suggestive effect of the electrical application on a people who were entirely ignorant of electricity and mystified by its manifestations.

But are we not doing very much of the same thing today only in a more advanced stage? The knowledge of the public is greater and superstition may have somewhat abated, but to counterbalance this our paraphernalia are still more wonder-creating.

Time and again I have known a patient to rise from an electrical application, when the battery had become suddenly out of order and there was no current at all, stating that he felt a wonderful improvement from the treatment.

I have seen warts and other growths removed by the x-ray. So have I many times seen the same thing done by a village conjurer. So I repeat again, there is no therapeutic agent in present use so liable to act in a suggestive way.

The ponderous machinery in the electrician's office, the thot of chain lightning, the sharp flash of the spark, the wonderful violet spray from the static machine and the marvelous x-ray, all have a tendency to excite faith, hope and expectancy. But suggestion is legitimate, it is justifiable; only as scientists let us not be confused.

I want to be distinctly understood as an advocate of advancement along all lines of scientific investigation. I thoroly believe in all branches of the healing art directed to the physical organism. I believe in internal medicine, surgery and electro-therapeutics.

I am proud of the progress we have made in our knowledge of electricity, and feel confident that we are still in the suburbs of this subject, and that splendid revelations will ultimately reward our labor in the future. All honor to such names as d'Arsonval, Apostoli, Daumer and Audin!

They have blazed the way, and it remains for us to take up the line of thot and study of this mysterious force that



seems to concern all matter, from the growth of the single cell to the ponderous evolution of planets thru the realms of space.

But gentlemen, while we grasp every source of knowledge relating to remedial

agents that act on the physical organism for the removal of disease, let us not forget that there is a psychic side to this question. Let us be thoughtful, let us be scientific, let us be honest. We *must* recognize the great law of suggestion.

## News and Notes.

### The Telephone as a News Vendor.

The distribution of the principal news items of the day by telephone instead of in the form of a printed newspaper has often been predicted, and is now actually an accomplished fact, tho on a limited scale only. Mr. M. W. Pershing, postmaster and editor of the *Tipton Times*, Tipton, Ind., controls a number of farmers' telephone circuits, which radiate in all directions from his office and, in many cases, extend for a considerable distance into the surrounding country. Mr. Pershing receives the Indianapolis papers about six p. m., and, after abstracting and summarizing the principal contents likely to prove of interest to his subscribers, he calls the latter up by 'phone, giving a simultaneous prearranged signal, which brings each farmer, anxious to learn the news of the day, to his instrument. Mr. Pershing then proceeds to retail to them the various news items which he has abstracted from the papers, including weather reports and market fluctuations. The verbal news system thus inaugurated is said to have become very popular among the surrounding farmers who have no other means of keeping in immediate touch with the rest of the community, and Mr. Pershing will probably have imitators.—*Electricity*.

**Hydrotherapy in Insanity**—Only recently the superintendent of one of our large asylums in writing to me said: "I have come to have very much reliance

upon hydiatic measures properly applied in the treatment of these cases, and I think the simpler forms can be readily applied in almost any household. One of the most effectual methods to quiet excitement, secure sleep, and promote elimination is the wet-sheet pack. Were I called to a private house this morning to see a case the type of which is familiar to us, with wakefulness, agitation, psychomotor restlessness, and the train of symptoms that accompany acute maniacal excitement or agitated melancholia, I should, if it were possible, first give the patient a large simple enema of water at 100° F. I would then thoroly wash out his stomach with sterilized water at about 107° F., then wrap him up in a large wet sheet saturated in water at about 112° F., and then thoroly roll him up in blankets, using two or three or more if necessary. A little experience will enable one to so envelop the patient in the wet sheet and blankets that however restless and uneasy he is, it forms one of the very best methods of restraint. We very often find that a patient in a wet-sheet pack soon quiets down and presently drops asleep, sometimes sleeping the night in the pack. In any event he often gets from one to two or three hours of refreshing sleep. When the pack is removed he can have an alcohol rub or a little light massage, which any intelligent person can give with a little instruction. There are dangers of collapse, but the signals of such danger

are so plain that the doctor will recognize them very readily, and his patient may be removed from the pack and such methods of stimulation resorted to as may seem to be required. When in the pack, ice to the head and hot-water bottles to the feet are important. This wet-sheet pack may be repeated when the patient again becomes restless or disturbed. The quantity of water which he drinks while in the pack promotes elimination, and this method is altogether so much more rational and simple than the heavy dosage by drugs that I think it important that it should be brought to the attention of every physician who is likely to have a case of acute insanity upon his hands for two or three days or longer.—*Dr. Hitchcock in Medical Age.*

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#### Colonic Lavage.

Dr. Milton H. Mack, in *The Chicago Medical Recorder*, January 15, 1904, discusses this subject in a sensible manner and points out (what seems to be generally unknown) its exceedingly great value in disease of the kidneys, and particularly in the cases in which there is suppression of urin. Dr. Mack commends colonic lavage particularly for chronic disease. He will find it almost equally valuable in nearly all acute inflammatory diseases.

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#### Radium as a Generator of Electricity.

Curie has shown that radium is a constant generator of heat, and now Wien has shown that by a suitable arrangement radium may be made a constant source of electricity. Rutherford has shown that both positive and negative electrons are thrown off by radium, and since the size of the positive electrons is several hundred times greater than that of the negative electrons, all that is necessary to separate

them is a sieve which will allow the negative electrons to pass thru while it retains the positive electrons. Many substances are capable of acting as sieves in this way—for example, glass. Wien (*Phys. Zeit.*, September 1) enclosed radium bromide in a glass tube into which a platinum wire was fused, and the positive electricity collecting inside was drawn off by this wire. This tube was suspended by a glass thread in a larger tube into which a second platinum wire was melted. The current was found to be of the order of  $3 \times 10^{-12}$  amperes. The radiated masses of the electrons calculated from this current came out for the positive particles  $4.6 \times 10^{-17}$  gram per second, and  $2.9 \times 10^{-20}$  gram per second for the negative particles. It is, therefore, totally impossible to determine the radiated masses by weighing. The energy of radiation, owing to the high velocity of the particles, is considerable, being for the positive electrons 60 ergs per second, and for the negative 8.7 ergs per second, from four milligrams of radium bromide.—*London Electr. Review.*

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#### Radium. -

The *Medical Council*, of Philadelphia, in its December and January numbers, gives a good report of radium and its effects upon the human body.

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#### X-Ray in Eye Diseases.

Dr. L. S. Downs, of Galveston, Tex., says *The Chicago Medical Times*, December, 1903, has demonstrated that the x-ray may be used with impunity for eye lesions. Injuries may be produced by too strong treatment. Three to five minutes is long enough for each treatment. He uses a moderately low tube and combines with it any other line of treatment that seems to be indicated.

### Light Therapy in Eye Diseases.

H. Strebel (*Klinische-therapeutische Wochenschrift*, November 8, 1903) has shown that the ultraviolet rays are transmitted much more readily by the tunics of the eye than by the skin and mucous membranes, and that typical reactions are produced in the cornea, iris, and conjunctival mucous membrane. The employment of the rays in the treatment of various forms of conjunctivitis, keratitis, and iritis is thus suggested. Thus far the work has been entirely experimental in character, no therapeutic tests having been made.

### Protection Against Rontgen Rays, and their Dosage.—

Levy Dorn says that this question is constantly acquiring greater significance, and that undoubtedly legal restriction will soon be imposed on users of the Röntgen rays to prevent injury to those examined and treated. No satisfactory means of actual measurement has yet been devised, but every radiographer can make observations which will enable him to form an estimate of the power of his apparatus under the various modifications of current, frequency of interruption, distance of the tube, etc. The author's rule is that the safe maximum exposure is twenty times that used for radiographing the adult pelvis. For this the plate is usually sixty centimeters distant from the tube, but the skin of the patient only thirty centimeters, so that the skin receives four times the intensity of illumination that the plate does. If the exposure necessary is two minutes, the maximal exposures will be 20-4 of the time—that is, ten minutes. A similar calculation is to be carried out if the data should be different, bearing in mind that the intensity of the x-rays, like that of light, is inversely as the square of the distance. Owing to the cumulative effect of the rays,

during a space of fourteen days the aggregate of the exposures should not exceed one and one-half times the maximum. It must also be remembered that inflammatory affections of the skins render it more susceptible to the rays even after the inflammation has subsided, and that young persons, mucous membranes, the face and back of the hands react very easily. Precautions for the operator himself are important but difficult to carry out. The hand should never be used as test object, a wrapped-up bone answering every purpose, and plates of lead, gauntlets of tin foil and metal screens should all be used to protect the person from exposure.—*Deutsche medicinische Wochenschrift*, December 3, 1903.

**X-Ray Prize Essays.**—Believing that the further development of x-rays is of great importance to surgery and medicine and the human race, and to encourage research and disseminate the knowledge gained, the *Illustrated Review of Physiologic Therapeutics* offers the sum of \$1,500 in cash prizes for the best essays on x-rays in medicine and surgery, the first prize being \$1,000. All surgeons, physicians and hospitals interested in any branch of x-ray work should write to the *Illustrated Review of Physiologic Therapeutics*, 19 East Sixteenth street, New York City, for information concerning title, time allowed, conditions, etc.

### The Degenerate Tonsil.

By Edwin Pynchon, M. D., (*J. A. M. A.*, March 21, 1903) commends very highly the electro cautery which he has used during the past twelve years for the removal of abnormal tonsillar tissue. Its advantages are a practically bloodless field, and no loss of the anesthetic. By the



cauterization there is destruction thereof should any portion of the follicular element escape the line of dissection. His results are ideal.

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#### Removal of a Five-Cent Piece from the Esophagus.

Dr. A. D. L. Brokaw, of St. Louis, describes in the *Interstate Medical Journal* for November the removal of a nickel which had become wedged in a stricture of the esophagus of a child aged three. The x-ray was used to determine the exact position of the nickel.

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**Electricity for Blepharospasm.**—Reuss found faradization of great value in photophobia due to mild cases of phlyctenular keratitis, and in cases in which lid-spasm persisted after the inflammatory symptoms had subsided. A single application often cured the blepharospasm.—*Alg. Wiener Med. Zeit.*, 1903.

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**Effects of Radium.**—At a recent meeting of the Academy of Sciences in Paris, Dr. Roux of the Pasteur Institute presented a paper detailing the results of exposing mice continuously to the action of radium. He hung a tube of radium in a cage containing mice, and after twenty days the animals lost their fur, which subsequently came out again, but was white. Exposure for a still longer period resulted in the production of a general muscular paralysis.—*Medical Record*.

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#### The "Iron Light" in Radio-Therapy.

Clasen has been favorably impressed with the action of the iron lamp, especially in acne and sycosis. Its effects are more superficial than those realized with the Finsen light, but his experience with

seventeen patients has shown that the new lamp, being within the reach of every practitioner can not fail to realize great progress in the treatment of cutaneous affections. For acne in particular it is the most convenient and agreeable method of treatment yet devised. In many cases in which the acne had persisted for years the skin healed over smooth after a few applications. He had only a single failure in his fourteen cases, and this one patient did not complete the course recommended. There are no subjective sensations from the application of the iron light. The lamp was designed by Dr. Bang, Finsen's first assistant, and is known as the Derma lamp.—*The Electro-Therapeutist*.

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#### Jail for Doctor and Nurse.

Judge Biddle, in quarter sessions court No. 1, Philadelphia, Pa., sentenced Dr. Stanislaus Rosmus and Martha Divoranschick, a nurse, convicted of conspiracy in securing \$121 from Katie Zocharewitz, to two years each in the county prison.

The conspiracy consisted of representations made to Mrs. Zocharewitz to the effect that she was suffering from a complication of diseases. The sentence was received by the defendants with tears.—*Medico-Legal Bulletin*.

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#### Prohibition as to Exhibitions of Hypnotism.

Chapter 219 of the Laws of Kansas of 1903 provides that any person who shall induce or permit any child under eighteen years of age to practice or assist or become a subject in giving public exhibitions of hypnotism, mesmerism, animal magnetism or so-called psychic forces shall be guilty of a misdemeanor, and on conviction be fined or imprisoned, or both.—*Medico Legal Bulletin*.



### Finsen Light Treatment.

United States Consul R. R. Frazier, at Copenhagen, Denmark, has reported recently on the Finsen Medical Light Institute, of Copenhagen, which was established in 1886 by Prof. Niels R. Finsen. This is now a state institution, and 1,367 cases had received treatment up to May, 1903. A recently issued report, covering the first 800 cases of *lupus vulgaris*, showed that 51 per cent have been apparently cured, and that in 35 per cent of the cases the treatment has been satisfactory, and cure seems certain. In only 5 per cent has the treatment proved unsatisfactory. Nine per cent of the cases disappeared from observation.

The treatment consists in bathing the diseased surface with light from a special form of electric arc lamp. The method seems to be efficacious for most skin diseases, but less so for deep-seated cancers. —*Electrical Review*.

### Treatment of Phthisis by High Frequency Currents.

Dr. Chisholm Williams reports forty-three cases of pulmonary tuberculosis, all of them over a year's duration. Forty-two of these increased in weight and lost all symptoms, excepting in a few cases where a slight cough remained and a few bacilli were occasionally found. The average time required for a severe case is three months, applications being made daily for the first month, every second day during the second month, and twice a week for the third. Those who possess a sufficient x-ray apparatus may adopt the treatment easily on procuring the necessary additional apparatus. Dr. Williams uses three methods, (1) auto-conduction, in which the patient is placed in a large solenoid; (2) auto-condensation, the patient lying on a couch; (3) the Oudin

resonator. He finds general treatment much better than local for tuberculous patients, and a combination better still.

### Radium in Medicinal Springs.

Professor Dewar recently found that helium exists in the waters of Bath, Eng. Hon. R. J. Strutt, the son of Lord Rayleigh, has found minute quantities of radium in the deposits of these same waters, but not enough to pay for extraction.

### A Singing Vacuum Tube.

William J. Hammer, of New York, in a letter to the *Electrical World and Engineer*, of January 2, 1904, describes a remarkable phenomenon which occurred in a Queen self-regulating x-ray tube, the target of which was recently perforated. A few days afterward a current was passed thru the tube until the anode became red hot. It was then laid upon a closed cardboard box, and suddenly a low but very clear musical note was given out from the tube, which could be felt to vibrate quite strongly. At other times the note did not begin when the tube was first laid down, but invariably a slight impulse would start it up. Sometimes it could be started two or three times without connecting to the coil. There was nothing near which could, so far as known, have caused the vibration, which lasted at different times from five to seventeen minutes. The writer suggests that the phenomena may be akin to the Trevelyan rocker or possibly to the air between the platinum and nickel plates of the anode. But referring to a London dispatch, which stated that a vacuum tube which had been lighted up continued to remain illuminated for ten days after its disconnection from the circuit, he suggests as a possible cause invisible ether radiations or waves.

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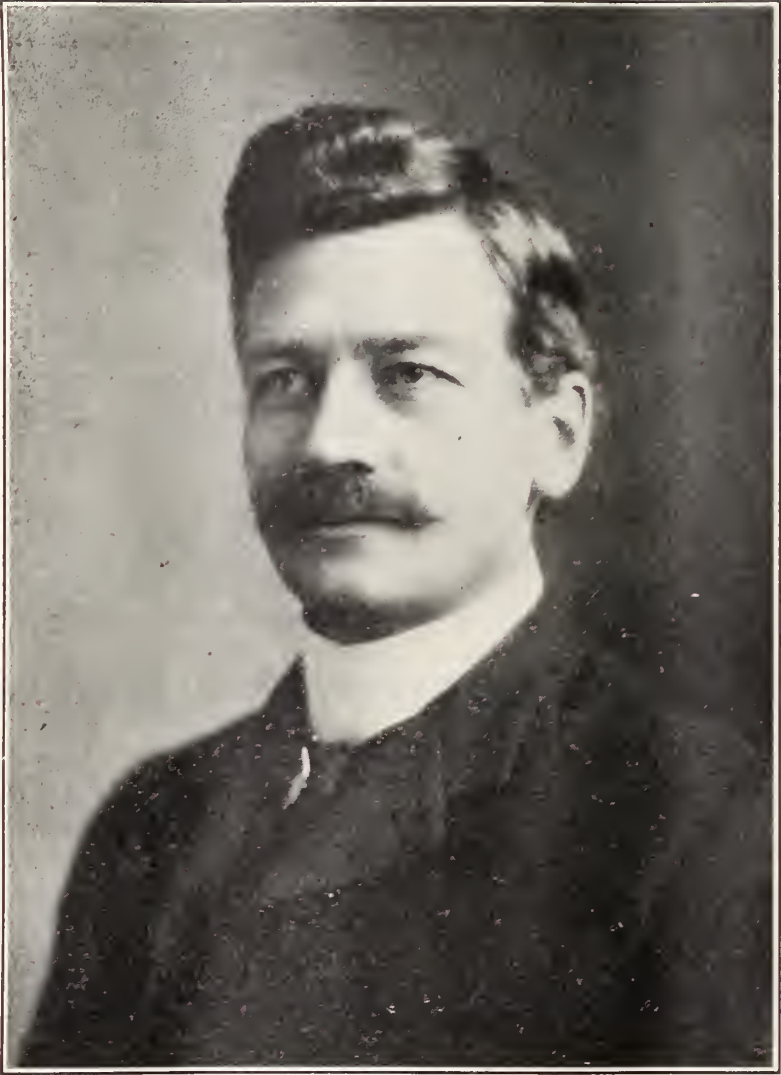
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*C. D. Collins M.D.*

Professor of Skin and Venereal Diseases, of Hahnemann College and Hospital; Consulting Dermatologist to the Chicago Half Orphan Asylum; Visiting Physician to the National Temperance Hospital, Chicago. Chicago, Ill.



# THE AMERICAN X-RAY JOURNAL

Devoted to Practical X-Ray Work and Allied Arts and Sciences.

VOL. XIV.

CHICAGO, MARCH, 1904.

No. 3

## Value of X-Ray and Electro-Diagnosis in Medico-Legal Cases.\*

BY JOHN E. KEHOE, FORMER TRIAL ATTORNEY, CITY OF CHICAGO.

In considering the various elements that have contributed to the sum of human happiness and advancement, it must be conceded that a deeper debt of gratitude is due to the medical profession than to any other body of men. All the sciences and all the arts have vied with each other in their efforts to do something in the way of adding to the pleasures and lessening the sorrows of human existence. But to enjoy the fruits of his labors and discoveries, one must be sound in body and mind, and the medical profession is the one that has gone to the very root of the matter, and has never faltered, no matter how great, how apparently hopeless the task, in its efforts to find the truth—to discover what a given disease really is, or a given complaint signifies, to search out the cause and apply a corrective.

Much there is in the progress and advancement of medical science that is worthy of praise and emulation, but I take it there is nothing that excites the admiration of thoughtful men so much as the promptness and frankness with which medical men will cast aside an old cherished theory or belief when the light of a new discovery shows it to be wrong. Other professions and other sciences, priding themselves on their spirit of foolish conservatism, will cling to an old principle or alleged truth long after it has been proved to be untrue or has outlived its

usefulness, but to the everlasting credit of medical men, be it said that they have the courage to court any criticism or ridicule in the advancement of a newly discovered truth that goes toward the amelioration of human suffering. No other field of human endeavor furnishes such examples of moral courage. The most sacred traditions of the past are trampled upon with impunity, the most cherished ideas abandoned, that a newly discovered truth may be disseminated for the advantage of mankind.

In that search for truth and in the development of the means of obtaining it, your profession has in recent years made discoveries and perfected inventions that are of incalculable advantage to your kindred profession of the law, in the preparation and trial of lawsuits. This accounts for my presence before you today. Being indecently healthy myself, I would probably not be brought in contact with your profession very much were it not for the great assistance received in the preparation and trial of cases by the x-ray and electro-therapeutical diagnosis. To understand what the x-ray and electro-therapeutics are doing for the law one must understand, to some extent, the changes that are taking place in legal practice and the rules governing the admissibility of evidence. The wonderful inventions of labor-saving machinery have

\*Read before the American Electro-Medical Society, Chicago, December 2, 1903.

almost made hand labor a thing of the past, but have greatly added to the number of personal injuries of one kind or another occurring in manufacturing plants. The craze for a high rate of speed in the operation of railroads, street cars, automobiles and all kinds of public and private conveyances add greatly to the number of personal injuries occurring in connection with travel, and in general the rapid pace that we are trying to live makes the number of personal injury cases almost appalling. The knowledge of these facts, together with a hope of financial recovery, is responsible for many more thousands of fraudulent claims for pretended injuries where no real accident has occurred. In many of these there is no real impairment of health, only a pretended illness or injury. In others there is a neurasthenic, anemic or other impaired condition, attributed by the patient to an alleged injury, but which is really due to other causes.

As a result of all those claims, the principal litigation in the courts here and in all other large cities of this country consists in the trial of personal injury cases. In Chicago, over one-half the time of the courts is taken up with the trial of this class of cases.

In all these trials two forces are constantly contending for supremacy—one trying to find the truth and bring it before court and jury. The other trying to suppress the truth and hide it from court and jury. Sometimes one of these forces is on one side, sometimes on the other. Occasionally partly on one side and partly on the other. But wherever located the two forces are always present, always struggling for supremacy.

In order that justice may prevail it is necessary that the truth should be obtained, and in arriving at the truth as to the character and extent of the alleged in-

jury in this class of cases, no single agency has ever been of such value as the x-ray is proving itself to be. Many reasons contribute to this fact. The jury, as a rule, is composed of men of no professional or scientific training. They can not understand a technical description given by a doctor, but they can see and understand an x-ray picture. Bear in mind that in the great majority of cases there is no external evidence of injury, or if there is any it is but slight as compared with the alleged internal injury complained of. The jurors have no accurate conception of internal anatomy, and a physician's verbal description often serves to only confuse them; but in illustrating and revealing the condition by means of the x-ray the practitioner is really resorting to the methods used in teaching little children in the primary grades in school, a simple, direct exposition of the truth, capable of being comprehended by the most immature mind. I could cite many cases to illustrate this. One that came under my observation while I was trial attorney for the city of Chicago is directly in point. The plaintiff, a man advanced in years, who had broken the right femur by falling into a hole in a sidewalk, came into court on crutches. The accident had occurred nearly two years before. It was contended that bony union had never taken place at the seat of fracture—in fact, that there had perhaps been no union of any kind, and that he could not use the leg and would have to travel on crutches the rest of his life. The physicians who had examined him differed sufficiently from one another in their diagnosis and prognosis to leave the jury entirely at sea as to the real condition of the leg. After his physicians, of whom there were quite a number, had all testified, I demanded an x-ray examination. After considerable pressure

on plaintiff and his attorney, and after it was made clear to the court and jury that an x-ray picture would show whether there had been a union or not, the examination was granted. They realized that to refuse longer would cause a strong suspicion in the minds of jurors that they were afraid of the truth. The examination was made and showed not only a union, but a very perfect one, and completely disposed of the plaintiff's contention that he could not walk without crutches.

In another case, the details of which are familiar to your worthy president, Dr. Pratt, it was claimed that there was a dislocation of the hip that had never been reduced, and, in fact, x-ray pictures were produced to prove this. A careful inspection of the pictures, however, together with the taking of pictures from a different position, proved conclusively that what was claimed to be a dislocation was only a tilting of the pelvic bones.

But there is another class of cases where the x-ray and electrical diagnosis are of still greater importance in arriving at the truth. I refer to that vast army of men and women, who, from some one of a multitude of causes, have become afflicted with some form of neurasthenia, hysteria, paralysis, epilepsy, or some other complaint more or less subjective in character, and who attribute their condition, sometimes honestly, sometimes dishonestly, to an accident for which they bring suit.

Under the laws of evidence as applied in this and most other States, a physician on the witness stand can not testify as to subjective symptoms that he found on examining a plaintiff, unless he is the at-

tending physician and made the examination in the course of his treatment for the purpose of finding what is the matter with the patient for the purpose of treatment. If he is called as an expert and has made the examination for the purpose of qualifying himself as a witness, he can only testify as to what he found objectively. This proved a great handicap in the calling of doctors as experts before x-ray and electrical diagnosis reached their present state of advancement. I was tempted to say perfection. For a skillful physician might be morally certain a condition existed and was due to given causes, but he would not be permitted to testify to it, because his conclusion was based in whole or in part on subjective symptoms. But with your present ability to look not only at, but thru the human body, you can now testify positively and objectively to a multitude of things that were formerly subjective and speculative.

Do you suspect, for instance, that a patient's condition is due to renal calculi or gallstones? Formerly you could not tell upon the witness stand, for your examination was subjective. Now you can testify as to the fact.

Is the condition one of locomotor ataxia, due to inherited or acquired disease? Is it hysterical paralysis, is it claimed there has been or is present a spinal concussion?

In these and a long line of other cases, which lack of space forbids my enumerating, the wonderful development of the x-ray and electrical diagnosis enable you to relegate to the rear the theories of old and substitute therefor practical, demonstrated truths. Gentlemen, the legal profession has much to thank you for.





# Cutaneous Hypertrophies.\*

## Their Treatment by Electrolysis.

BY H. PERKINS FITZPATRICK, M. D., PH. R., PROFESSOR OF DERMATOLOGY IN CHICAGO  
COLLEGE OF X-RAY AND ELECTRO-THERAPEUTICS.

If it be your pleasure it is our intention to direct your minds for a few moments from the more serious subjects previously and so ably discussed during this session, to a few minor defects involving not the physical but the cosmetic condition of the patient. We will include under the above heading not only those hypertrophies of the epidermis, the corium and subcutaneous connective tissue, but also those of its appendages, such as blood vessels, hairs, lymphatics, sebaceous and sweat glands. In all hypertrophic dermal changes we have a proliferation of the cells of certain elements. The epidermis may be involved as in callosities. The papillæ may be affected as in verruca. The pigmentation may be increased as in lentigo and chloroma. The hair may be multiplied as in hypertrichosis. The connective tissue may be involved as in scars or keloids. The vascularity may be increased as in angioma, telangiectasis and acne rosacea. Pigmentary increase and fatty degeneration may occur as in exanthema. Epithelial proliferations may occur as in cutaneous cornus. We find these hypertrophic changes from the most infinitesimal to the gigantic; all radical departures from the normal, even if in their incipency benign, may become malignant later. We will confine this article to those hypertrophies which from their inception to time of extirpation are benign, leaving the malignant to their proper domain—x-ray and excision.

We will consider first hypertrichosis, which as you know is an increase of the lanugo hairs, usually, tho not necessarily in the female. This development may be so slight as to cause no concern and again

may appear so rapidly and so conspicuously as to cover the entire face with a heavy hairy growth. Few dermatologists but can cite over a dozen cases successfully treated whose hirsute growth would exceed or at least equal the most vigorous beard. Experience has shown that this is a congenital growth. That is, that those so afflicted inherit a predisposition to its development. Unfortunately this inherent tendency is abetted in every conceivable way that promises temporary alleviation. The most popular of these hair developers are depilatories, epilation, pumice, singeing and the razor. No growth, no matter how excessive, is beyond the aid of electrolysis. I have just completed a case that had used the razor for over seven years and from whose face it was necessary to remove over 20,000 hairs. This was done in less than four months without visible trace of its former existence. What you need for this work is a good galvanic battery. One of from six to twelve cells is as good as the largest cabinet. A needle holder, epilating forceps, connecting insulated cords, platinum electrolysis needles, a good eyesight, a steady hand and some experience.

With such an outfit and your patient in the chair, connect your needle holder with the cord of the negative (zinc) pole and have the patient complete the circuit by grasping a sponge electrode attached to the cord of the positive pole, or, as I much prefer, by inserting one to three fingers in a bowl of water previously connected to positive pole. No connection should be made, however, until needle has been inserted into hair follicle. Unless you make and break your circuit at each

\*Read Dec. 2, 1903, at the Chicago meeting of the American Electro-Medical Society.



insertion and removal of the needle, the shock and pain will be intense. No set rule as to amount of current can be given. The location of the hairs, as the lip, chin or cheek and the idiosyncrasy of the patient must all enter into your calculations. Ordinarily for the less sensitive parts of the face, as the chin and neck, you may use from two to three milliamperes at first, which can gradually be increased to five or six. For the sensitive nostrils and lips from one to three milliamperes is about all you can expect your patients to tolerate. An experienced operator will destroy from sixty to seventy hairs in a sitting of one hour. If proper precautions as to making and breaking the current are used patients will take daily sittings of three to four hours when necessary. To prevent scarring by coalescence of the vesicles a beginner should scatter his work, but an experienced operator can clear a thickly studded surface without the slightest danger to the integrity of the integument. To most of you having to do with questions of life or death these minor defects usually create little, if any, interest. But I believe they will arouse you to a sense of their importance when you take into consideration that these abnormalities are frequently the originators of many obscure neurasthenias. The old axiom "nervousness predisposes to hypertrichosis" is to those who have observed these cases minutely much more truthful if transposed to read "superfluous hair predisposes to nervousness."

The fallacy of the old saying is the more readily verified by removing the growth. Then, no matter how depressed, morose or insomniac the patient may have been previously, the consciousness of its presence, the hypersensitiveness and nervousness immediately vanish. I have given more space to this distressing featural deformity than I intended, but I

believe three-fourths of the women of today are thus afflicted more or less, and therefore its almost universal prevalence is some excuse for this feeble endeavor to arouse a more general interest in the only known method for its successful elimination.

The x-ray will never be popular because of its tendency to destroy the integrity of the capillary circulation. No method, unless it can be so used as to leave the integument free from marks, scars and discolorations, will long be favored by a public ever quick to discriminate between the worst and the best. Therefore until some way is found to so utilize the x-ray as to obviate its after effects upon the cuticle, it will meet with little encouragement from the hirsutically afflicted.

We will next direct your attention to angiomas, a very disfiguring, congenital vascular hypertrophy. They are either bright red or purplish, their color depending upon the preponderance of arterial or venous circulation. They are amenable to treatment by electrolysis. As they increase proportionately with the growth of the victim their eradication should be undertaken at the earliest possible moment. In this treatment it should be your intention to set up an irritation sufficient to occlude and eventually obliterate the plexus of capillaries. Owing to their intimate connection the probability of re-establishing a collateral circulation in some of the vessels treated precludes the possibility of thoroly eradicating an angioma at one sitting. Each treatment, however, shows such a marked improvement that it does not require a person of decided intelligence to foresee its complete elimination. If the birthmark is thoroly covered at each sitting from three to seven sittings at intervals of one to three weeks will destroy them. From

four to six milliamperes, or even more if tolerated, will give you the quickest and best results. Here is where we get to use an alternating, that is a positive and then a negative current, with good results. By using a single needle and transfixing the visible vessels we use first the positive and then the negative poles until the part transfixed is thoroly blanched. By removing the needle and reinserting at the point of furthest electrolytic action we continue the above procedure until the mark has been covered. If the work is thoro we will have a resultant crust formation, a general constriction and cicatrization of the growth with the certainty of its complete eradication at an early date. Gentlemen, while there are many improvements in store for electrolysis we of today have certainly eliminated the uncertainties. We know what electrolysis will do. Given a telangiectasis (and, by the way, there's where we catch the prohibitionists), we know if we begin at the tip of the nose and thoroly occlude the distended capillary to point of insertion into the deeper vessels, we will make our patient happy and pocket a good fee freely paid. For this work, owing to the nostril being so sensitive, from one to three milliamperes of the negative pole will be all we can reasonably count upon using.

Given a nevus pigmentosus we know that if we transfix the elevated tissue repeatedly, using from two to four milliamperes of negative galvanic current, we will soon set up sufficient decomposition to cut off the circulation. We also know that the tissue so transfixed and decomposed will dessicate and drop off to a level with the surrounding surface, leaving the face free from all trace of the former defect. If it is a cutaneous horn of the nose or cheek, no matter how insignificant nor how long or large it may be, we know

that if we decompose the horn at the point of insertion into the nose until it is softened sufficiently to lift away, the resultant scab will drop off in a week, leaving no evidence of former growth. If it is an artificial hypertrophy like tattoo marks, we know by tattooing with the needle we will set up enough inflammation to carry away all traces of india ink in the ensuing crust formation. We know chloasma and lentigo are caused from an excessive pigmentation of part affected—we know by thoroly tattooing the pigmented parts we not only insure the elimination of the present pigment deposit, but by destroying the plexus of capillaries we prevent their reformation.

The smaller fibroids, cysts and all warty growths need but one treatment to completely remove them.

In all elevated growths the needle must be inserted thru them, the intention being to reduce the growth to a level with the surrounding surface.

In nevus pigmentosus pilaris the hairs must first be removed and then the pigmentary deposit and hypertrophied tissue destroyed by inserting needle thru the growth as in treating nevus pigmentosus verrucas, cutaneous cornus or cysts. From three to six milliamperes and a negative current of the galvanic battery should be used unless otherwise specified.

In closing I wish to say this subject is interesting only in so far as it tends to introduce to your notice and press upon your attention the more universal adaptation of electrolysis for the alleviation of all cutaneous hypertrophies. Depressing as they are to the hypersensitive, mortifying as they are to their intellectual sensibilities, nerve destroying as they are by the ever present consciousness of their hideousness, we who have made their eradication by electrolysis a specialty, re-

ceive our first reward in the self-evident gratification of the patient. No fees are paid with greater pleasure than those for some actual cosmetic improvement. When not engaged in the relief of mankind's greater ills there is no better nor no more thoroly appreciated profession than that of catering to the fastidious by eliminat-

ing their hypertrophies, knowing what we can do and how to do it. Electrolysis of today is on a firm scientific basis. I predict that it will grow in favor from year to year as the profession realizes more and more its importance and are convinced as they surely will be of its future possibilities.

## Dangers to the X-Ray Operator.

BY JOHN T. PITKIN, M. D., BUFFALO, N. Y.

### CHAPTER III.

The sequelæ of x-ray inflammation are:

(1) More or less loss of integument with its appendages, hair, hair-follicles (alopecia), nails, sebaceous and sudorific glands.

(2) Disfigurement of parts involved, such as hands, face and head, by scars, pits, warts, pigmentation, baldness, a shave that requires no repetition, skin diseases, etc.

Small cicatrices form at the labial commissures, drawing the angles of the mouth downward, giving the operator a sad expression of countenance. Dr. Wagner, of Chicago, suffers with disfigurement of the face and loss of one finger. A French operator is reported to have nearly lost his nose. Clarence Daily (case to be reported in subsequent chapter) has scars upon his face and loss of hair. One entire hand and four fingers of the other have been removed. Dr. Early, of Columbus, Ohio, has lost one finger. Dr. Kassabian has many small scars upon his face. Pigmentation has rendered his face much darker than its normal condition. A light streak separates the pigmented portion of his features from the hair of his head, giving him somewhat the look of a person wearing a mask. A picture of his hands is shown elsewhere. Girdwood, Grubbe, Kassabian, Skinner, Price, Waite, Platt, Detwiller, Weigel, Pratt, Leonard, and

about one-third of the prominent operators and instrument dealers have hands which have been more or less severely injured. Drs. Marsh and Leonard have injured feet. Blacker (case to be mentioned later) has gone on "the long journey to that bourne which no traveler e'er returned."

(3) Chronic scaly skin diseases and other conditions of the parts result because some of those little functionaries, the sweat and oil glands that have moistened and lubricated your skin from the days of your inception are gone forever.

(4) Horny papillary thickening of the ends of the fingers beneath and around deformed nails, crowding the nails away from their matrices; horny ridges, lumps, nodules, warts, or callos in other localities. Some of those formations mark the sites formerly occupied by inflammatory mounds. Most of these formations can be softened and stripped off, but they usually form again in the same places. Their subsequent degeneration into cancer will be considered later.

(5) Purpura hemorrhagia and punctate clots in the newly formed skin; the bleeding probably comes from the nutrient arteries of the defunct follicles.

(6) Erythema, either circumscribed in small irregular spots in the skin and beneath the nails or diffused over the entire surface.



(7) Hyperemia or anemia, usually the former results, the latter being confined to circumscribed areas.

(8) Pigmentation or blanching of the tissues, either temporary or permanent. The surface may be left with a pigmented border and white center, as shown in an accompanying picture. Dr. Pancoast has shown us how the denizens of darkest Africa can be whitened.

(9) Hyperesthesia to all forms of radiant energy and traumatism. This condition slowly decreases.

(10) Increased vaso-motor activity.

(11) Diminution or loss of the sense of touch in circumscribed areas. This sequel is rare.

(12) Small abscesses at the roots of the teeth (rare, see case reported at the Philadelphia meeting by Dr. Bullitt).

(13) Temporary decrease in sexual power.

(14) Erratic or redundant growth of hair. See report of Drs. Girdwood, Skinner, Pancoast and Newcomet.

(15) A tendency to spasmodic muscular contraction and edema.

*Secondary, Tertiary, Quartanary Dermatitis.* — From careful observations made upon patients and myself, I conclude that each attack of x-ray inflammation leaves the parts more predisposed to subsequent attacks; consequently, after several repetitions, from a given volume, strength, tension and duration of exposure, the period of incubation decreases while the inflammation developed will be more and more intense. One hand of the operator may develop dermatitis in a few days while the other, which has been less frequently or less severely attacked, requires a week or more for its appearance; the former will be severely, the latter slightly affected. Even the different fingers of the same hand

may have a different period of incubation and degree of reaction according to their relative susceptibility. After repeated attacks the period of incubation may be entirely wiped out, the reaction with a sensation of warmth or stinging and an inflammation more or less profound taking place immediately. Conversely, a period of rest from raying limitedly decreases susceptibility.

Why the hands are so frequently injured and why upon the dorsum:—

(1) They are not protected by clothing.

(2) They are usually a little nearer the tube than other portions of the body, dorsum outward.

(3) It is a common practice with operators to employ the hand in front of the fluoroscope, dorsum presented to the tube, as an x-radiometer, judging by the translucency of the bones, etc., the degree of penetration of the x-light.

When the operator is right-handed he will instinctively hold the fluoroscope in that member, consequently the left hand will in the course of time be more seriously injured. The reverse is true if left handed. When ambidextrous both hands will be nearly equally affected.

*Other Dangers of the X-Ray Operator—Impairment of Vision.*—At the Chicago meeting of this society Dr. Scott, of Kansas City, reported that he had been so afflicted, attributing the same to the Roentgen Rays.

Personally I am unable without glasses to read medium print, which I could do seven years ago before I became an x-ray operator. I consider the x-ray more or less responsible, but the fluoroscopic and dark-room work, not to omit the hand of time, have each contributed their quota to the impairment.

Mr. Thomas A. Edison reports that the focusing power of one of his eyes has been lessened by the Roentgen rays.



Dermatitis, second month, showing exfoliation of epidermis, inflammatory mounds and rugae.



Dermatitis, fourth month, showing injuries to nails, papules, horny nodule on index finger and continued desquamation.



Osteosarcoma of bones of the face. Under treatment the bones came out en masse.



Post dermatitis condition of hand of Dr. Mihran K. Kassabian, x-ray expert, Philadelphia, Pa.





Dermatitis of entire abdominal wall. The inflammatory process has subsided, the hair over the symphysis pubis is largely lost, the parts are left with a pigmented border and white center. The patient has cancer of the colon and rectum. Under treatment x-ray outside and radium tube inside, portions of the growth have passed per ani.



One-half of face involved with cancer. (Died.)

One of my x-ray colleagues has a mild form of ophthalmia which he believes to have been caused by the rays. Withdrawal from their influence is always followed by improvement. Drs. Kassabian and Waite have been similarly affected.

Ophthalmoscopic examination of my eyes made during an x-ray inflammatory

moving bodies upon the window pane, showing irritation of the retina.

A nurse in my employ who sustained a facial dermatitis complained of a mild form of blepharospasm that accompanied and for a time followed the attack.

*Effects of the Roentgen Rays Upon the Generative Organs.*—When the x-



Cancer of forehead.

attack, revealed a deficiency of pigment in the choroid. The pupils of my eyes were small, and there were indications of presbyopia, such as inability to focus perfectly the crystalline lens for near and remote objects. Vision at thirty or forty feet was a little blurred and indistinct. This defect was overcome by distance glasses, but since my recovery such glasses are no longer required. I saw minute

ray operator has a mild, but general, attack of dermatitis the reproductive organs will darken. The hair over the symphysis pubis may or may not be thrown off. There will be desquamation of the scrotum and glans penis, although an investing foreskin of the penis may not be affected. The sexual power will be temporarily lost. (See report of experiments made upon the spermatozoa of rab-

bits at the meeting of the American Roentgen Ray Society, Philadelphia.) The urin contains no albumin.

*Collapsing of Crookes Tube and Cutting of Flesh by the Flying Fragments of Glass.*—This accident occurred to Dr. King, of Bradford, Pa., and was reported in THE AMERICAN X-RAY JOURNAL, July issue of current year. The entire subject, including the danger to the eyes of the operator, has been considered by my predecessor, Dr. Pancoast.

For other cases illustrating this danger I refer you to the current literature dealing with the subject rather than weary you with further quotations.

In order to throw the searchlight of investigation upon one of the etiological factors of cancer I inquire of a patient who has that disease upon the forehead (see picture) what was the cause? She replies the sting of a mosquito. I ask another suffering with epithelioma of the lips and cheek the same question (see picture), he says a cut from a barber's razor. Still another with osteo-carcinoma of the bones of the face (see picture) says he was struck with a stone. A patient with one-half of his face involved fell upon a plank that cut his lip. Cancer subsequently developed in the cicatrix (see picture). A lady with scirrhus of the breast and a metastatic focus on the face believes the primary lesion to have been caused by falling against a bedstead (see picture). In other words, slight injuries to epithelial tissues, in accord with the teachings of Conheim, the German savant, often proves a potent cause of cancer. Is it strange, therefore, that x-ray inflammation with its specific action upon this variety of tissue, be it physiological or pathological, should very rarely cause a cancer in an operator having the cancerous diathesis, by degeneration of the horny ridges, nod-

ules, warts, cicatrices, etc., left as sequels, or a retrograde epithelial metamorphosis superinduced by the inflammatory process?

Patients subjected to a course of x-ray treatment of over one year's duration who are not thoroly shielded from the action where not required, may become emaciated, the parts exposed may have eruptions, oedematous swelling and spasmodic contraction (slight), painful or otherwise. This danger is limitedly shared by the operator.

The rays have been accused of causing headache, indigestion and other disturbances of the stomach and bowels, sore throat and symptoms like those produced by a mild sunstroke, by different operators and writers, some of which I have previously mentioned in the context; that all of these conditions may and do exceptionally result, I have good reasons to believe.

*Preventative Measures.*—In view of the multiple dangers that beset the x-ray operator I have adopted the following precautions:

(1) Never allow the use of any portion of my body for others to look thru.

(2) Never change the adjustment of a tube or position of patient while the apparatus is in operation.

(3) Never allow the strong destructive rays in the center of the field to shine upon my person.

(4) Never use the hand in front of the fluoroscope as an x-radiometer.

(5) Wear the safety gloves invented by Dr. Price, of Cleveland, and of this society. Silk or rubber gloves lined with foil are better than no protection.

(6) Wear glasses as an extra protection for the eyes against the action of the rays and the disruption of tubes.

(7) Wear an office coat with extra long sleeves that come well over the backs of the hands, the skirt of coat to cover the



hips, the entire garment interlined with foil or the Price material.

A safety fluoroscope can be made with a hood fitted over the trunk and attached around the margin of the distal extremity, the hood to be large enough to extend over the head, face and hand of the operator, or a rigid flaring metallic plate can be fitted around the middle of the trunk of the fluoroscope on its outside, extending laterally therefrom, and a thick piece of plate glass fitted to the inside of the removable end of the instrument.

(8) Not to excite the tube with a sinusoidal current or what amounts to the same thing, overload the direct current with spark gaps and thus change it into the sinusoidal. A tube thus excited scatters rays in nearly every direction.

(9) Remain behind the target, the static machine, or thick plate glass screens having metallic bases thru the glass of which I can observe all that is transpiring, or examine my patient who holds the fluorescent screen, while I remain excluded from the x-ray field.

(10) If obliged to enter the field for any purpose, remain as far away from the excited tube, work in the outer confines as much as possible, do what is required, then return to a position of safety immediately. Another good plan for self-

protection is to screen yourself from such pencils of x-light as would come your way with a copper plate placed so that you can see the working of other portions of the tube, or screen the entire tube, and observe its reflection in a looking glass.

A combination screen and tubeholder to invest the tube on all sides with a suitable aperture for the egress of the rays can be made of very thick glass.

The new form of clinical adjustable tables, with a copper or sheet iron covering nailed onto the wooden top, the top turned on end, make admirable impromptu screens for many purposes.

The foreign makes of tubes said to be opaque to the rays except at a limited area, are worthy of trial.

Such precautions I now scrupulously maintain, for my recent experience with this subtle force reminds me of the words of Shakespeare given to the ghost of the erstwhile Hamlet, king of Denmark (paraphrased):

"My hour has almost come

When I to sulfurous and tormenting flames

Must render up myself.

Doomed for a certain term to walk the night;

And for the day confined to fast in fires,  
Till the foul (unnatural condition) of  
my body is burned and purged away."



### The Legal Status of X-Rays.

Hon. W. W. Goodrich, of the Supreme Court of New York, in *Brooklyn Medical Journal*, December, 1903, cites various court decisions in which the x-ray is admitted as evidence under the same conditions as to accuracy and reliability that apply to an ordinary photograph.

### Radium.

Dr. D. A. Stapler, of San Francisco, has found that sweet pease exposed four days to radium grew quicker and the plants were considerable larger than others not so exposed. He concludes that short exposures to radium stimulate the growth of cells, long exposures destroy them.

## Electro Therapy.

A Course of Twenty-four Lessons under the auspices of the Chicago College of X-Ray and Electro Therapeutics.

### Lesson 10—APPLICATIONS OF STATIC CURRENTS.

In using the direct current from a static machine, the first essential is to have the patient form part of the electric circuit. This is done by connecting one part of the body directly or indirectly by means of a conductor with one pole of the machine and another part of the body with the other pole. The second essential in giving static treatment is to have an air gap in the circuit. This is for two purposes, to control the current by increasing or decreasing the resistance and to obtain the sensory effects upon the patients. Such matters as insulation of the patient, grounding one pole, using some particular electrode, etc., are matters of relatively small importance. If an insulating platform is used the legs should be not less than thirty centimeters long. Most treatments can be given equally well without the platform.

If the patient is connected directly to both poles of the machine the current produced is very small. An air gap is therefore required in the circuit. If the air gap is bounded by rounded surfaces the current passes at intervals in the form of sparks. If the gap is bounded by one or more points the current takes the form of a spray or breeze. The local effect of the sparks is irritating. A spray may be so strong as to be irritating, but a mild spray or breeze acts as a tonic or an astringent. The effects previously described as belonging to the anode and kathode, respectively, are added to the sensory effects. Years ago when the best static machines gave excessively small currents, measured in hundredths or thousandths of a milliamperé, the sensory effects so greatly exceeded the chemical that the latter were frequently lost sight of. With a good ma-

chine, giving one or more milliamperes of current, the chemical effects are distinctly marked.

In giving a treatment one pole of the machine may be connected with a large conductor, such as a gas, steam or water pipe, and the circuit completed by making a connection from the latter to the patient who is connected directly with the other pole of the machine. This arrangement is practically the same as that first described, the only differences being that the resistance of the circuit is now slightly increased and the electro-static capacity is very greatly increased, enabling heavier sparks to be given than when the connection is direct. Beyond mystifying the patient, the arrangement has no special advantages. The spark gap in this case may be either between the patient and the ground (if he is insulated), or between the patient and the machine. If it is between the patient and the ground the operator may himself form part of the circuit and deliver the current by a conducting electrode held in the hand. For very mild treatments, particularly about the face, he may use a wooden electrode, slightly dampened.

The amount of the current is regulated in part by the speed of the machine and in part by one or more air gaps. The longer the air gap, the smaller the current.

The general rule for regulating the dosage is that patients whose circulation is vigorous require stronger treatments than those that are anemic or in whom the circulation is sluggish. In the latter the chemical effects are cumulative at the poles.

The alternating current is obtained from the static machine by placing the

patient in the circuit whose connections are with the outer coating of the two Leyden jars. In this case also the first essential is to have the body of the patient form a part of the circuit. The electromotive force of this circuit is not so great as in the direct circuit, and it is usually necessary to place the electrodes in close contact with the body. No spark gap is required in the lower part of this circuit. The electromotive force of this circuit is increased by increasing the length of the air gap between the discharging rods of the machine. The intensity of the current increases with the electromotive force, with the size of the Leyden jars, and with the conductance of the circuit.

In applying this current it is advisable to begin with the sliding rods in contact. In this position the alternating current is zero. The rods are then drawn apart as far as may be necessary to obtain the desired current. Insulation of the patient and the grounding of one electrode are matters of indifference. If a spark gap is placed in the lower part of this circuit, of such a size that the current will barely pass, the current itself becomes unidirectional, or, in other words, a direct intermittent current, similar to that obtained from the prime conductors of the machine. If, on the other hand, the resistance of the lower part of the circuit,

including the body of the patient, is small and the capacity of the condensers is sufficiently large the current becomes oscillating in character.

The alternating current is valuable chiefly for its effects in stimulating metabolic changes. Non-malignant tumors, localized infections, chronic inflammations, and all cases of defective metabolism which are not due to an insufficient supply of nutrition nor to defective elimination, are very favorably affected by the alternating current. In those cases in which there is any considerable amount of septic material the alternating current must be used very guardedly, as the introduction of this material into the general circulation may give rise to serious or even dangerous results. In such cases the treatment must be brief and mild at first, and the channels of elimination must be kept actively open. In constipation the use of the alternating current upon the intestine frequently stimulates the absorption of poisons.

The effect of the alternating current is marked upon muscular tissue generally. In acute disorders of the nerves and other internal organs it is frequently of great advantage to treat the whole muscular system. This treatment combined with active elimination is often sufficient to cut short the acute attack.





## News and Notes.

At the last meeting of the Chicago Electro Medical Society, held March 14, a resolution was passed commending the action of the Illinois State Board of Health in instituting proceedings against non-medical users of the x-ray and electricity, for taking x-ray photographs, extraction of hairs and other applications of electrolysis to the human body.

The meetings of the society will hereafter be held quarterly instead of monthly. The following officers and committees were elected: President, Dr. Stuart Johnstone; first vice-president, Dr. Sheldon Leavitt; second vice-president, Dr. E. G. Trowbridge; third vice-president, Dr. Hamilton Forline; secretary, Dr. T. P. Hall; treasurer, Dr. R. S. Gregg. Members of the executive committee: Drs. H. P. Pratt, A. Ralph Johnstone, E. S. Pettyjohn. Membership committee: Drs. J. L. Hammond, C. J. Nichols, J. E. Gilman. Judiciary committee: Drs. O. W. McMichael, J. R. Hawley, P. S. Replogle.

### Radiography of Gallstones.

At a meeting of the Academy of Sciences of Paris, held last month, Drs. Maclaure and Infroit described how they had obtained a radiograph of gallstones. This is, it seems, the first time that such a result has been obtained. A small tube, which was "osmo regulateur," and charged by a static machine with eight plates, was placed at seventy-five centimeters from the radioplate, on which the patient was placed directly. A bandage of linen, thirty centimeters large, served to compress the abdomen. The tube was but slightly penetrating and the pose only lasted ten minutes.—*J. A. M. A.*, Oct. 31.

This is rather late in the day to claim priority, however. Gallstones were successfully photographed in the body by

Dr. R. S. Gregg in Dr. Pratt's laboratory, Chicago, verified by operation by Dr. Byron Robinson, and reported in the *Electrotherapeutic and X-Ray Era* in December, 1901. Dr. Gregg has photographed several since that date.

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### Is X-Ray Photography Medical Practice?

A case of unusual interest to the medical profession was decided on January 8, 1904, by the Supreme Court of Minnesota—Henslin vs. Wheaton, et al. The action was by the appellants against the appellee for damages caused by x-ray burns, the facts in brief being as follows: The plaintiff was under the impression that he had inhaled into his lungs the gold crown of one of his teeth, and for the purpose of locating the substance called on the defendants for the purpose of receiving medical advice and treatment. The defendants exposed his person to the x-ray and took two skiagraphs in an endeavor to locate the substance, which were fruitless. The plaintiff felt no immediate consequences of the treatment, but after a period of time he felt severe pains upon his back and was advised that he had received what is known as an x-ray burn. The usual allegations were made in the plaintiff's complaint, charging unskillfulness, etc. On the trial the plaintiffs called a certain professor as an expert witness, who testified that he was familiar with electricity and the use of the x-ray machine. The plaintiffs sought to show by this witness that it was negligence to apply the x-ray to the person of the patient with the tube only two inches from the body and the extent or degree the flesh would be affected is determined by the nearness of the exposure, and also that nearness of the exposure was likely to cause an x-ray burn,

when if further removed such would not result; in short, the testimony of the witness, if received, would tend to show unskillfulness and negligence on the part of the defendants. On the objection of the defendants, the lower court excluded the evidence; applying the rule, in *Martin vs. Courtney*, 75 Minn., 255, so well established; that a physician must be judged by the standards of his own school of medicine, and for this reason members of a different school can not be introduced as expert witnesses touching upon the skillfulness, etc., of the treatment administered. The Supreme Court, however, decided that this rule does not apply in the case at bar and reverses the decision of the lower court, saying in part as follows: "The application of the x-ray to plaintiff was not for the purpose of treating any disease or ailments from which he suffered, but for the purpose of locating, if possible, a foreign substance thought to be in his lungs. While it perhaps may in some instances be used as a remedial agent, it was not so employed in this case. The so-called x-ray, discovered by Roentgen, has been recognized and known to scientists, both in and out of the medical profession, for some eight years. During this time the apparatus for the generation of x-rays has been used very generally by electricians, etc., for experimental and demonstrative purposes. It is a scientific and medical appliance, the operation of which is the same in the hands of the college professor or the physician of the allopathic, homeopathic or any other school of medicine. It may be applied by any person possessing the requisite scientific knowledge of its properties, and there would seem to be no reason why its application to the human body may not be explained by any person who understands it. The rule in the *Courtney* case, therefore, has no application to the case at bar. It

might apply, if it appeared that the application of the x-rays to plaintiff's person was for medical purposes, and not for the scientific purpose of discovering the presence of the foreign substances in his lungs."

It appears to us, however, that in the above case there was a fixed scientific and medical question, the claim for damages was certainly predicated upon the negligent use of the x-ray machine as applied to the plaintiff's person. No doubt the scientist could testify to the use and properties of the x-ray, but we do not see how he could qualify as an expert witness to testify as such in a case where the only question involved was the skillful or unskillful application of the x-rays to the person of the plaintiff. As is stated in this case, the defendants conceded that some bottles were more susceptible to the influence of x-rays than others and, regardless of the distance of the apparatus from the person of the patient, x-ray burns may or may not result. If the physician, therefore, is to be judged by the standards of his own school, we fail to understand how a scientist, not a physician, could be qualified as an expert witness.

Another phase of this question occurs to us in this way: From the report of the case we gather that the application of the x-ray machine to the plaintiff's person was for the purpose of diagnosis and was made by men who held themselves out as practicing physicians and surgeons. Evidently the plaintiff went to the defendants because they were physicians and surgeons and for the purpose of obtaining relief. In other words, the treatment he was to receive was "therapeutic" in its nature, and the skill, etc., used in applying the same should be judged by the standards of the physician's own school.—*Medico Legal Bulletin*.

### Medico-Legal Facts of Hypnotism.

Dr. W. L. Howard, of Baltimore, Md., in the *Pacific Medical Journal* for February, states that it is not probable that one person can exercise complete control over another when not in his presence; that a person under complete hypnotic control is not aware of it at the time, and will not accuse the person controlling him of the commission of a crime upon him; is not afraid of him, and can not recollect what transpired while in that condition. If the subject is hypnotized later by another person he will tell the truth about his first experience unless under strong post-hypnotic suggestion. These views were given by him as expert opinion to Judge Bailey in connection with a criminal accusation against a physician.

In our experience the subject who is under complete control is exceedingly rare, and to the extent of the control his opinions, memories, emotions, and actions are subject to the direction of the hypnotist. After the condition he may or may not remember what has occurred, and it is not well for an expert to make general assertions too positively in matters that are only partially understood.

### The Present Condition of Radio-Active Science.

It is seldom that a discovery so purely scientific as that of radioactivity has awakened and held the interest of the lay mind as persistently as has that of radium. This is, perhaps, partly due to the lively interest shown in this new field by the scientific world, which usually receives and discusses new discoveries as a matter of course. But these new phenomena, with their apparent paradoxes and surprises, disturbed the usual scientific calm and started so many skillful investigators to work that it is difficult even for those who make it a point to follow the science,

to keep informed in regard to the latest development. There is no doubt, also, that the popularity of "radium" has been fostered by the unwarrantable deductions which have been drawn by those not fully informed of all the facts. Radium has been hailed on the one hand as a source of unlimited power and on the other as a cure for all diseases, and its use has been suggested for about everything between these extremes.

#### MISUSE OF TERM "RADIUM."

The term "radium," by the way, is being rather misused. The radioactive substances which one sees exhibited are not radium, but the salts of this element, and they should be called by the proper term. To call them "radium" is just as incorrect as it would be to call sugar "carbon."

#### THE PROCESS OF DISINTEGRATION.

Those who are interested in radioactivity will find in the concluding article of a serial on radioactivity published in the *London Electrician* by Mr. Frederick Soddy, a summary of the present condition of this science. It will be remembered that radioactivity is now supposed—by one school of physicists, at least—to be brought about by the disintegration of the atoms of radium or the other elements having this property. This disintegration apparently takes place in stages, each stage occurring abruptly, the character of the change in the different stages being different for the several substances. There exist during these intermediate stages transition forms differing both from the primary and final result. Thus, for thorium the first transition form to be produced is thorium X, which is distinguished from the thorium itself by differences in the chemical properties. The next stage produces the thorium emanation, in which a volatile substance is set free. The third and last stage produces a substance not



volatile. In the case of radium, a gaseous emanation is set free during the first stage of disintegration, and this changes into a non-volatile matter. In uranium only one intermediate form is known.

#### THE RADIOACTIVE EFFECTS.

During these disintegrations three actions may be distinguished. These are designated by the three radiations, the  $\alpha$ ,  $\beta$  and  $\gamma$ . The  $\alpha$  radiations are supposed to consist of small particles of matter having sizes of the order of the hydrogen atom, which are shot off from the material at velocities at times as high as 20,000 miles a second. Since the radioactive substances have atomic weights over 200 that of hydrogen, a number of these particles might be lost by an atom without materially affecting its atomic weight. The radiations are supposed to be particles much smaller than the  $\alpha$  particles, and are thrown off with much greater velocity, in some cases approaching the velocity of light. The  $\gamma$  radiations are not supposed to be particles of matter, but real etheric vibrations similar to Röntgen rays or light, except that they are far more penetrating. Thus, as the heavy radium or thorium atom disintegrates, it throws off particles about the size of hydrogen atoms—that is to say, weighing about one-two-hundredth of the atom. It may throw off particles in size about one-seven-hundredth that of the hydrogen atom, and, in throwing off the latter, the invisible light waves are set up.

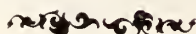
#### OTHER PHENOMENA.

These views have naturally encountered strong opposition, though they seem to

offer the best explanation of what takes place. But the whole story has not been told. According to the electron theory, atoms are made up of groups of electrons, the latter being the small unit charges of negative electricity. One would expect, then that the  $\alpha$  rays, which represent the positive charges, and the  $\beta$  or negative charges would be produced in equivalent quantities; but this is not found to be the case. In the first stage of disintegration the  $\alpha$  particles only are set free. And, furthermore, it appears that, altho the atom may throw off a positive charge, the residual matter may remain positive. It would seem that there must be some energy changes going on which have not yet been determined.

#### IS ALL MATTER SLOWLY DYING?

Another interesting side of this subject is the explanation of how it happens that these unstable compounds have persisted through the ages until today. These changes are taking place with extreme slowness, and it is even possible that the radioactive materials themselves are intermediate stages in the disintegration of a primal element. On the other hand, it may be that all matter is passing through this process of disintegration, is living its life, though the change, as compared with that of the radioactive materials, is so slow as not to be detectable. As shown above, an atom might lose particles without the change in atomic weight being detectable. The change may be so slow that the electrical effects are not measurable, and the products can not accumulate in sufficient quantities to be detected by chemical means.—*Electrical Review*.



## Adjustable Anode for X-Ray Tubes.

BY R. V. WAGNER, M. D., CHICAGO, ILL.

The shadow of an object in sunlight has its edges blurred, on account of the light coming from a large number of points. The shadow of an object under the light of an arc lamp, on the other hand, is sharply defined because the light comes from a very small area. These

same differences appear in x-ray pictures and in shadows upon the fluoroscope. When the kathode stream comes to a



sharp focus upon the anti-kathode the x-rays diverge from that as a common center and a sharply defined shadow or picture is obtained. The focal distance

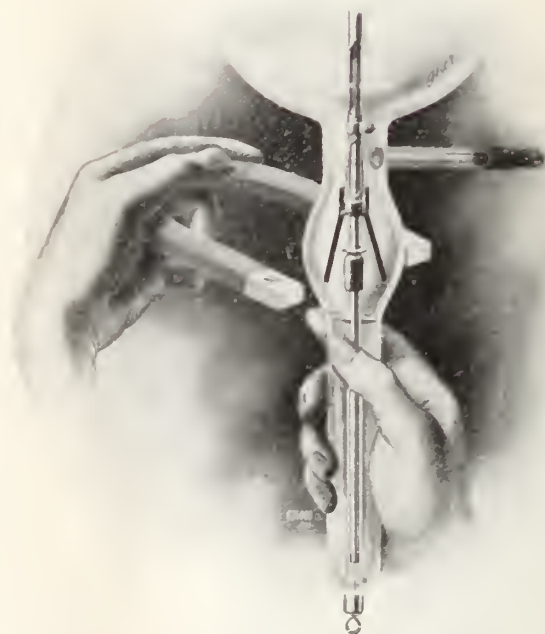
points. The shadow of an object under the light of an arc lamp, on the other hand, is sharply defined because the light comes from a very small area. These

varies with the vacuum of the tube, consequently it is not possible to insure sharp definition under all conditions with even the best tubes, and in constructing a tube the maker is obliged to guess at the best distance to make between the kathode and the anti-kathode. There is no way of testing the accuracy of his guess until the tube is exhausted and properly excited.

In my new tube the anti-kathode is mounted on a threaded stem which can be magnetically operated thru the glass, so as to move it up or down or circumfer-

of the anode. It will stand an unlimited degree of heat and unlimited usage, even with the sharpest focus.

The difference between x-ray work done with a properly focused tube and that done with a tube out of focus may be appreciated by holding a wire screen (20 mesh) between the tube and the fluoroscope, with the latter twenty-four inches distant. When the tube is perfectly focused the holes may be distinctly seen with the screen at least twelve inches distant. With a poor focus it may be



entially with the surface of the tube, in order to obtain an accurate focus. The method of operating is illustrated in the figure. The little armature on which the magnet acts cannot get out of adjustment and will hold the anode in any required position, either in focus for radiographic work, or out of focus as is sometimes required for therapeutic purposes.

In my tube the anti-kathode is made of platinum especially thickened at the center and electrically welded to the body

necessary to bring the screen close to the fluoroscope.

[This kind of tube has been needed for a long time. Every radiographer has had endless difficulties in selecting the right tube for a particular piece of work. We are satisfied that in many cases the difficulty has been with the focus of the tube. The fact that the focal distance changes with the vacuum of the tube makes an adjustable device of the greatest importance for accurate work.—ED.]



## Some Experiments and Conclusions in Hypnotic Therapeutics.\*

BY W. H. WALLACE, M. D., OF DISPUTANTA, VA.

My attention was first called to hypnotism in a medical way in 1898. In the summer of that year I met a lady who assured me she was a natural born "magnetic healer." She affirmed that by a few strokes of her hand she could put her husband (who was an invalid) into a sound sleep. He was subject to various neurotic pains, which she could always control by stroking. Numbers of her friends assured me they could feel a peculiar thrill when she touched them. I had never heard hypnotism mentioned in my medical course, and had always considered it a humbug, but here were a number of reliable people whose word was not to be questioned, who assured me they could feel *something* pass from this lady's hand to their own. What was it? Animal magnetism, as she asserted? or hypnotic suggestion? It was two years later that I began some experiments on my own account. My wife was affected with pains along the course of the sciatic nerve, and one night I said carelessly, "Oh, I can stop that in two minutes." I massaged both nerves lightly and told her her pain was gone; she moved them and felt no pain. She was not nearly so much surprised as I was. From this I concluded that hypnotism was not all humbug, so I purchased a set of good books on the subject and went to work to investigate more thoroly. I have been thus prolix, to show that it was no hypnotic grand-stand play that brought me to a study of the subject, and that, at the beginning, I was anything but prepossessed in its favor.

Following instructions of Yerkes, of

\* Read before the Thirty-fourth Annual Session of the Medical Society of Virginia. Reprinted from *Medical News*.

Harvard, I could readily hypnotize hens and discovered that some were more easily influenced than others. I met a young lady who told me she had been hypnotized several times, and I had no difficulty in putting her in the rigid, so-called cataleptic state.

After this I began to use my newly-acquired accomplishment freely as a means of relieving pain in all suitable cases, such as neurotic headaches, insomnia, and all kinds of obscure functional nervous troubles, and as an aid to hasten the effects of chloroform in anesthesia. I was successful in stopping night-sweats of phthisis, and put a patient (who had an idiosyncrasy for morphine) to sleep in the agonizing crisis of locomotor ataxia.

I wish now to call attention to a few, to me, remarkable cases before attempting to draw conclusions:

*Case I.*—Mrs. G., aged fifty-three years, married, no children; had been an invalid for twenty years when first coming under my care, and had all the clinical symptoms of phthisis and a bountiful supply of the *Bacillus tuberculosis* in her sputum. She was very weak; had precordial pains and could not sleep. I had exhausted the pharmacopeia in endeavoring to give her rest. It occurred to me one evening that this would be a heroic test case for hypnotism. I put her in a comfortable position, and in ten minutes I had her sleeping soundly and she slept all night. As long as she lived I could make her comfortable by a few strokes of my hand and a few firm words of suggestion or command. Her husband suffers from locomotor ataxia, and has an idiosyncrasy for morphine, which crazes him. I had run

the gamut of anodynes in his case when the crisis was on and had given him very little relief. In his case I used a revolving mirror, fixing the light behind him and getting the mirror in such a position that it would flash the rays of light in his eyes. He was in such pain that his cries could be heard for a block away. To quiet his craving for something to take I gave him five grains of bromid, and fixed his attention on the mirror, explaining to him that the rays of light would paralyze the ocular nerves, etc., and he would soon fall asleep and be free from pain. Difficult as he was to control, in fifteen minutes he was sound asleep, and he slept for two hours. I then put him to sleep again, and he slept all night without rousing. In the room with this patient was a half-grown puppy, and the colored nurse called my attention to him just as I had got my patient asleep. The puppy had been attracted by the bright revolving mirror, and when I looked at him he was blinking and unsteady on his legs, and in a couple of minutes fell over against the hot stove, which awoke him.

*Case II.*—The next case I wish to speak of was a stout woman, aged sixty-two years. She suffers with valvular trouble, and has asthmatic attacks at times. She became frightened and precipitated an attack one day while I was away. When I saw her, some three hours later, she had the most irregular pulse I ever felt, and had an abiding fear that her end was near. I got her to bed, and with a few quiet strokes over the temples and appropriate suggestions she went to sleep, and now, after some nine months, she has not had a recurrence.

*Case III.*—My next case worthy of mention was one of delirium tremens. Mr. M., a married man and a farmer; had at one time been a pillar of the Church, but, like many pillars, had fallen.

When in his cups that seemed his chief grief. When I went to see him he was in a particularly bad fix, his horses were running away with him and deacons were putting him out of church. He would not take medicine nor allow me to use a hypodermic, and he was too powerful a man to think of using force with, so I decided to try hypnotism. It was out of the question to try ordinary methods, because I could not hold his attention; so, assuming a tragic air, I shouted to him, "Don't you see the water around your feet, they are trying to drown you, get to bed, quick!" He took the suggestion readily, and seemed in abject terror of the water. I was then able to control him, and in half or three-quarters of an hour had him asleep. I went home hoping to hold him till morning, but he awoke in two hours, though more rational, and in a couple of days was over his attack. He had another spell six months later, however, and committed suicide.

*Case IV.*—A Bohemian young man came to me from Pennsylvania with some obscure nervous trouble. He had been to see several specialists and was growing progressively worse. He had vague pains in calves of legs and thighs, weak back; was unable to work and had constant headache and roaring in his ears. Strange to say, none had thought to examine his ears; and I had been treating him for two weeks before it occurred to me to look for impacted cerumen. Both auditory canals were packed full, and how he could hear so well with them in that condition is a mystery to me. I syringed them out, and thought I had solved the riddle of his case, but in a few days he began to grow worse. I had his eyes examined and his vision was 20—20, no trouble there. I had been using electricity, superheated hot air to spine and cold

douches. As a last resort, I tried hypnotism and in ten days I had him out in the field at work. Of course, I gave him tonics in conjunction with the other treatment; but the fact remains, that he did not commence to mend until I had hypnotized him several times.

I have thus briefly run over these cases to show effects, or, better, results. I will now try to draw some conclusions. I am not quite prepared at this time to follow the latest teaching as to the action of, or cause of hypnotic sleep. Nearly all modern writers claim that suggestion is all there is to it. I can not believe this; I have hypnotized chickens by holding their feet, laying them on a board and putting a grain of corn in front of their beak. I can see no suggestion in this. As I have stated before, I involuntarily put a puppy to sleep with a revolving mirror. To my mind, the whole keynote of the phenomena is concentration; suggestion only helping to hold the mind or concentrating it.

It would not surprise me at all to find the students of the science (if I may so call it), at some later date go back to the teaching of Mesmer, and show that there is a psychic force that produces the phenomena we call hypnotic sleep.

I do claim, however (and believe that further research will bear me out), that hypnotism has a definite physiological action, as much so as any drug of the pharmacopœia. So far as I have been able to find out no one has ever advanced this theory, and thereby hangs the secret of much of the neglect of one of the most powerful weapons in the armamentarium of the physician. I do not claim that it is a cure-all. I do not even believe that every physician is capable of exercising it successfully, but to a large body of the profession it is a wonder-worker in a great many cases. Up to this time, as I have said, it has been used empirically and

mostly by quacks and advertisers; but because a quack uses a thing that is good it is no reason that we of the regular profession should ignore it, and if we can show that its effects are at all times the same or nearly the same—that all patients submitted to its action behave the same, I think we are justified in claiming that it has a definite physiological action. I believe that its action is simply this: attention is concentrated on, or by something to such a degree that strain is put on the vasomotor nerves, resulting in a paresis of the whole vasomotor system, with a consequent diminished blood pressure. A patient submitted to hypnotic suggestion is invariably (in my experience) starts off with a rapid small pulse, a little later it gets harder, slower and full, and as hypnosis comes on tension diminishes, and if you put one of them into deep somnambulism, the pulse is flaccid and slow. As I said before, blood pressure is diminished, what results? Blood is very easily determined to any portion of the body, because the vessels are wide open, with but one exception. I believe that whereas in physiological sleep the brain is anemic, in hypnotic sleep it is congested, for though the body is asleep the brain is still active and blood is bound to circulate more freely where there is most activity. Now, then? I concentrate a patient's attention on a rapidly revolving mirror, and suggest to him sleep. I say you are bound to sleep if you keep your gaze on it. He concentrates his attention on it, all else is blotted out, his whole attention is on that mirror, and sleep dominates him; blood is pouring into the brain, where activity alone is going on; surroundings get hazy and he does not notice anything but that dominant suggestion, sleep, and as a result he is soon asleep. Well, what happens then? We will suppose he is a man who has been



troubled with a mild neuritis of the leg and foot. He is sleeping soundly, with a brain turgid with blood. I say to him, "You feel no pain in your leg or foot." His attention is now directed to that foot, there is a rush of blood to the particular brain center that presides over that limb, the brain cells of that center are crowded together and massaged against one another by the flowing blood, gradually nutrition there (because of increased metabolism) is increased.

The center that appreciated pain no longer appreciates it, not by any wonderful psychical process, but by a simple reasonable physiological process. Well, some one says, "You have not removed the source of irritation; when the patient wakes the pain will return, you have not increased metabolism in the limb." I am not too sure of that. True, if there is any material organic change of the tissues that is causing the irritation, it may not be possible to cure it except by extended treatment, and perhaps not then; but at the time you draw the patient's attention to the painful area metabolism increases in that part as much so as in the center presiding over it. Tissue changes take place, the parts are flushed out because of diminished tone of blood-vessels, and the minute vessels are capable of taking up larger extraneous particles than they would at any other time; and they are so taken up and swept out of the tissues and into the general circulation and on, out of the system.

To recapitulate then, my idea is that the phenomenon of hypnotism in its action on the human economy is a definite physiological process. It has its psychic side to be sure, but I do not care to discuss that at this time. I believe that it cures pain and many functional troubles by a process as easily understood as is the physiological action of—say digitalis

or opium. I know that some of my deductions are not capable of proof, but how many things in medicine are? I have carried on my studies and experiments during the exigencies of an extensive country practice, and this thesis is far from what I would have desired. But if it will help to stimulate research in this field by some better prepared and more fortunately situated than myself, and if I have succeeded in demonstrating that hypnotism is a therapeutic agent too good to be left to charlatans, my labor will not have been in vain.

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#### Radium in Texas.

With regard to the recent reports of the discovery of radium-producing minerals in Texas, a correspondent in that State writes that the Nernst Lamp Company is mining rare earths in the locality known as Barringer Hill, which is situated 11 miles from Kingsland, Tex. This region yields gadolinite and five other new and rare minerals. The mining of yttria ore on a large scale, it is stated, gave rise to the reports that radium was being sought. It is stated that the Nernst Lamp Company is trying to purchase more land containing the earths and minerals which it utilizes in the manufacture of its lamps, but the owners have raised the prices to almost prohibitive figures. It is asserted by representatives of the lamp company that the gadolinite which it is mining does not contain radium or radioactive properties. The land owners say, however, that this statement does not agree with the reports of disinterested scientists who have recently conducted tests and examinations of the mineral. These assert that the earths possess a greater amount of radioactive properties than those of any other known region in the world.—*Electrical World and Engineering*.

## Thirty Years' Progress in Electro-Magnetic Theory.

It is very interesting to consider the growth and development of electric theory during the past three decades. It has not been so much in the physical or pure theory as in the applied theory that the advance has been made. In the fundamental theory of the science, as reflected in the works of Gauss, Weber and Maxwell, thirty years ago, there is comparatively little increase; but in electro-technical theory there has been a great advance and development. For example, the theory of the magnetic circuit has been developed during the last thirty years, and without this theory very little practical development could have been made in the art of constructing dynamos. All advances in construction would have been by empirical groping. Thirty years ago there was no alternating current technology worth mentioning. Our recent industrial development of power transmission has rendered necessary an applied science of alternating currents which is already extensive, and is constantly extending.

In the direction of electromagnetic waves, science has made notable advances in three decades. In that time the proposition has been set up and established that radiant energy is of electromagnetic nature, viz.: an oscillatory electromagnetic disturbance in the ether. Waves of radiant energy have been artificially produced by electric means with wave lengths as small as a few inches; but no artificial electric mechanism has yet been devised to produce wave lengths as short as a few microns, the condition necessary in order that the retina may respond, and the stimulus of light be produced. Of recent years the electronic theory has made great strides as a working hypothesis. It is still only in the stage of partial develop-

ment. It is very comprehensive in its scope, since it may be said to offer an explanation of all matter, on the basis of electrical point sources in the ether. It also attempts to explain the phenomena of mechanical inertia, or the vis-inertia of matter, on the basis of self-induction in moving electrons, i. e., the moving charges that by postulation form matter. According to this theory, all electric charges are associated with ions or portions of atoms. No communication of electric charge can occur without the movement of such ions. Electric waves in free ether are, however, capable of carrying away the energy of such ions. All this theory has been created during less than thirty years, and if not yet demonstrated it must at least be admitted that each succeeding year gives more support to the theory.

Concerning the fundamental nature of electricity itself, there is still no certainty, but there are several hypotheses. There are several theories for explaining both electricity and magnetism in terms of the ether. None of these theories seems capable of being submitted to experimental demonstration. It is certain, however, that, since the interconnection between electricity and magnetism is known a demonstration of the nature of the one must, by corollary, include a disclosure of the nature of the other. Moreover, it would now seem likely that the complete unraveling of the nature of electricity would necessarily include a revelation of the nature both of matter and of gravitation. All that can be said with reasonable certainty at present seems to be that electricity and magnetism are states of disturbance in the universal ether, although the exact kind of disturbance can not yet be defined, partly because the mechanism of the ether itself

must be sufficiently known in order to differentiate its disturbed conditions from its normal conditions. In the case of air, as an atmosphere on the surface of our globe, we have a sufficiently clear idea of its nature to enable us to say that a streaming disturbance of the air, necessarily accompanied by spinning or vorticity, constitutes the phenomenon that we all recognize as wind. Wind may, therefore, be defined as a particular disturbance of the air. Sound, as it reaches our ears, we attribute to a different kind of disturbance in air. So it seems clear, in like manner, that magnetism and electricity are particular disturbances in the ether. Just what the disturbances are is not clear. But we know that the two disturbances are mutually related in the manner that streaming is related to spin or vorticity in an incompressible fluid. Consequently, as the material for producing wind is always present, if we have suitable mechanism, say a fan, and power to drive it; so the material for producing electricity or magnetism is always present in the universal ether, if we have suitable mechanism, say a dynamo, and power to drive it.—*Electrical World and Engineering.*

#### Death from X-Ray Burns.

About five weeks ago a prominent business man of our town, who was in fine health with the exception of a chronic eczema which gave him no trouble except occasional itching, was induced to take x-ray treatment for his eczema. He took the treatment given him by a physician who lives in a neighboring town. The doctor gave him several exposures, and burned him over a space of about 10x12 inches on his back on both sides of the spinal column, including the spinal column, and extending up to the neck. The true skin all sluffed off, leaving a red, raw, discharging surface. He was also burned

on the left portion of abdomen, about 4 x6 inches; also over the left lumbar region, about 4x8 inches, but not quite so deep. The burns discharged very profusely, and were the most sensitive sores I ever observed. They were very red, and often the most simple dressing would cause severe pain, and would have to be removed in a few minutes. At times the itching was so severe that nothing but full doses of morphin would control him. After about three weeks' suffering, delirium set in, which continued for about five days till death relieved him of his suffering. Able consultation was had in the case. Both local and constitutional treatment was carried out; tonics internally, antiseptics locally, and the patient was nursed carefully; but the burns were too severe; they would not heal and were too exhaustive.

I may be extreme, but after witnessing the suffering and finally the death of one of the best men and a leading citizen of our town and community from excessive x-ray burns, I feel sure that I would not have an x-ray machine in my office. I write this to *The Medical World*, hoping that thru its columns many physicians may be made more cautious and prudent in the use of the x-ray; for I do not believe that the extent or degree of x-ray burns can be properly estimated. They are dangerous and will produce death.

Springtown, Tex. A. S. GARRETT, M.D.

[The x-ray is a two edged sword, and the greatest trouble is that you don't know what harm you are doing till after it is done. It acts very differently on different people, some stand it very well, while others are very susceptible to it. Unless the greatest care is taken to test each patient's susceptibility, it is easy to do much more harm than good. The November 11th meeting of the Philadelphia County Medical Society was given



to a symposium on the use of the Roentgen (x) ray, by a number of gentlemen who have used it much. A number of cases of carcinoma and tuberculosis were given in which it acted like magic; and other cases were given in which it failed utterly or did harm, and some severe burns were reported, but not to such an extent as to cause death. The consensus of opinion was that while it acts beautifully in some cases, we are not yet able to differentiate the cases in which it will act favorably; and until we can do so, we should proceed cautiously, and not neglect other methods of treatment. Eczema was one trouble in which one operator (Dr. J. F. Sehamberg) had gotten most satisfactory results from its use.—Ed.]—*Medical World*.

#### Finsen Lamps.

The greatest obstacle in the more general use of the Finsen treatment is the cost of the apparatus as used at the Finsen institute (Lysinstitute) the length of each exposure, seventy-five minutes, and the expense of a constant attendant. In the last seven years the rearrangement of lenses, etc., has reduced the time of exposure fourfold. The Finsen-Reyes lamps are designed for the treatment of one patient at a time and lessens the amperage used from 80 to 20. This lamp is smaller and much less expensive than the original lamp, but requires an attendant.

In the effort to invent a lamp by which the cost, maintenance and length of treatment could be reduced, two principles, chiefly, have been utilized. In one class of lamps the electrodes have been made of iron, or other metals, giving light very rich in the ultra violet rays; in a second class the electrodes are of carbon but the source of light is brought much nearer the region to be treated, the condensers dispensed with and the amperage reduced

to ten or twelve amperes. Of the second type of lamp, the best known is the Lortet-Genoud and a modification of this by Dr. Sequeira, known as the "London Hospital Lamp." Dr. Montgomery speaks well of this latter lamp, from personal experience. He says: "In both these lamps the carbons may be brought within two inches of the surface to be treated, water circulating between two quartz lenses, cutting off the heat rays: The amperage is ten to twenty and the voltage fifty-five. In a considerable number of cases the results of treatment with these lamps have been very satisfactory and obtained more rapidly and with less expense than with the original Finsen apparatus." He formerly thought that fifteen minutes' exposure, apparently gave the same reaction as an hour's exposure with the Finsen apparatus, but a longer experience with the lamp has shown that while it is unquestionably cheaper and more convenient in every way than the original Finsen lamp, and while it is efficacious in superficial cases, it has not the power of the original lamp and does not reach effectively the deep-seated conditions. This is also the opinion of Sequeira, Leredde, Morris and others. The much spoken of Bang's lamp has iron electrodes and causes quickly a reaction which is more superficial than with the other lamps. These lamps illustrate or verify the dicta of Professor Finsen that "it is not light alone, but a large quantity of light which cures lupus."

Busek claims that he can produce an effect equally as quick with the original Finsen as with the other smaller ones, even those with iron electrodes. Kromayer thought that the reason the rays from the smaller lamps with the iron electrodes did not penetrate was because the large quantity of ultra violet rays they produced caused so much irritation that the exposure could not be sufficiently pro-

longed, therefore he tried removing the most refrangible rays by filtration. But Bnsck showed that the iron electrodes gave a light containing a few blue, violet and ultra violet rays of short wave-length and therefore could not be expected to penetrate like the longer rays from carbon electrodes. It has been demonstrated by Fiussen, Freund Bie, Stretell and others that light is bactericidal and that the ultra violet rays were the most powerful. Jansen concludes from his studies at the Lysinstitute that concentrated electric light employed for an hour and a quarter will penetrate the skin with bactericidal power to a depth of 1.5 mm., and with a retarding influence upon the growth of bacteria to a depth of 4 mm. Montgomery concludes that of all known methods of treating forms of tuberculosis of the skin phototherapy gives the best results. Phototherapy is, however, not as effective as the x-ray in patches covered by hypertrophic epidermis or crusts or where there is much pigmentation.

Phototherapy has also proven of value in lupus, lupus erythematosus, rosacea, alopecia areata, certain vascular naevi and circumscribed diseases of the skin. In the treatment of deeper diseases the results have not been encouraging.—*Dr. M. F. Engman, in Interstate Medical Journal for January.*

#### **Recent Researches in Radio-Activity and Electricity.**

Dr. J. S. Wight, of Brooklyn, said that he had been able to show that the high-frequency discharge would coagulate blood and serum-albumin, in part due to the formation of nitric acid from the air;

but there was no destruction of tissue with ordinary care. He had employed this in connection with his method of electrical grafting.

In carrying out this method, the surface should be made sterile and then curetted thoroughly. While still oozing, grafts should be applied, and the high-frequency discharge applied with a pointed electrode until clotting was firm and the grafts were fixed on the dry surface. The serum squeezed out in the process of clotting should be sponged off, and the part dressed with 3 per cent carbolized vaselin. This dressing would not adhere. It should be renewed on the third day. Healing would be hastened by an application of the secondary Roentgen rays. These rays were produced by an apparatus which Dr. Wight exhibited. These rays were not reflected, but were truly secondary, being emitted at the elbow of the tube from a plate of metal or paraffine.—*Medical Record.*

#### **A New Form of X-Ray Tube.**

In the *Electrical Review* for February 27 William Rollins describes a vacuum tube designed for treating diseases of the surface. The cathode is convex, instead of having the usual concave form. The cathode stream proceeding from it does not come to a focus, but is scattered against the opposite wall of the tube. The tube itself is made bell shaped, and the x-rays are given out from the base of the bell where the glass is bombarded by the cathode stream. The tube is contained in a non-radiable case to protect the physician and is provided with a handle.



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SYMPOSIUM ON  
THE AMERICAN  
LAWYER



DR. SHELDON LEAVITT.

Vice-President Chicago Electro-Medical Society. Author of "Psycho-Therapy."

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## Psycho-Therapy.

BY SHELDON LEAVITT, M. D., CHICAGO.

A mere cursory survey of facts must convince one that mental medicine has a rational foundation. When we look out upon life's experiences evidence is everywhere found that mind is the dominating force among men. The deeper we go in our study of human experience the clearer becomes this truth. One mind controls another. By potent reasoning, by luminous example, by persuasive eloquence, men are swayed in their opinions and their conduct. We are natural hero worshipers. We prostrate ourselves before those who have become conspicuous for courage, for wisdom, for goodness, and for skill, and murmur our adoration.

Not only does one mind come to dominate another, but it acquires a power over the physical energies of the universe. Man takes unseen forces and makes them drive his machinery, carry his messages, light his cities and warm his houses. The utilities that intelligence has been able to evoke fill us with astonishment; but the limit has not been reached.

Nor is the field of mental triumph limited to the outer world. Indeed, its most astounding conquests are hidden in the depths of man's own being. His greatest conquest is the conquest of self, and his great creation the creation of his own destiny.

The powerful effect of mental upon physical conditions is patent to the mere

tyro. One can not study the varying phenomena of organic action without recognizing the destructive power of mental concepts and emotions. In a patient who is very ill mental shock is able to turn the balance against recovery. To see hope fade from the countenance may mean that we shall soon see the pallor of death stealing over it.

"It is quite true," says one, "that depressing emotions may kill, but that does not establish your thesis."

No, but if destructive that can depress human vitality, can not constructive that elevate and sustain? It is a poor rule that will not work both ways. With reference now to both drugs and mental concepts it may be safely affirmed that if there are depressants there are likewise stimulants and tonics. In short, the time has come when we should no longer close our eyes to the truth that clinical experience with psychic remedies develops evidence of the same character as that adduced from the use of other remedies, and of equal weight. In fact, many of us have become convinced that much of the evidence that has been cited to prove the value of drugs justly belongs to the domain of psycho therapy.

This is a tempting theme for discussion, but we are liable to become bewildered if we go far into it without following a definite line of thought. Much of mod-

ern psychological that is valueless, save as it awakens a taste for the esoteric, because it is put forth without logical coherence.

What is of superlative value to us in the direction of cure is to determine (1) whether the subjective mind can be influenced in a deliberate and systematic way by the objective, and (2) how such influence is best exerted. It will be perceived that the importance of this study lies in the fact that it is the subconscious mind that presides over the functions of organic life.

An eminent professor in one of our leading universities, in writing of the evidence warranting a belief in psychotherapy, says:

"On every hand we are invited to come and see, and any disposition to ignore the facts thus open to observation, while at the same time wholly condemning the beliefs in the name of which they are wrought, justly leads to a charge of prejudice and lack of scientific method. In fact, the evidence of most remarkable cases of healing under all these systems of belief is so abundant that I shall not hesitate to assume without argument that we are here dealing with one or more genuine healing agencies."

Disease is evinced by what we call symptoms. These symptoms are of two general varieties, objective and subjective, the latter being those that are felt and the former those that can be determined by means of physical exploration. We admit that a case can be symptomatically cured without essential change in the objective conditions. For example, a woman with a retroverted uterus may be relieved of all sense of discomfort without restoration of the organ to what we call a normal position. To her this amounts to a cure, since conditions that present no subjective evidence of abnormality are es-

entially normal. On the other hand, the same woman, with her uterus in a normal position, and everything else in a seemingly healthy condition, may still suffer pain. The natural forces may be unable to cast out a bullet which has become imbedded in the trunk of a tree, or even in the body of a man, and the pathologist may tell us that there exists an abnormal condition. But nature comes to the rescue, restoring the cellular disorder which resulted from the penetration, and the tree, or the man, continues his unimpeded movement of life forces as is evidenced in unmodified functional activity.

This dual manifestation of mind, as seen in conscious and unconscious action, while it defies comprehension, commands our respect. It must be that the mind makes the body, rather than the body the mind. It is the mind of the cell that determines cellular development; and the human body is but an aggregation of cells. Only when mistaken for the reality and idolized does the body become eccentric and tyrannical. Viewed as an external manifestation it grows beautiful and comes harmonious with the environment of its own plane.

In what manner the subconscious mind is influenced and its actions modified and directed are the very things about which we are learning something in these days of varied practice.

As one out of many of the psychic truths that have been developed I may mention the exceeding value to healthful mental and physical functioning of an active volition. "Be systematically ascetic or heroic in little unnecessary points," says Prof. William James. "Do every day or two something for no other reason than that you would rather *not* do it, so that when the hour of dire need draws nigh it may find you not unnerved and untrained to stand the test. Ascetism of



this sort is like the insurance which a man pays on his house and goods. The tax does him no good at the time, and possibly may never bring him a return. But if the fire does come, his having paid it will be his salvation from ruin. So with the man who has daily inured himself to habits of concentrated attention, energetic volition, and self-denial in unnecessary things. He will stand like a tower when everything rocks around him, and when his softer fellow mortals are winnowed like chaff in the blast."

I will mention one more demonstrated law given us by the new psychology, and that is the surpassing value of faith as a condition of cure. There must be faith on the part of both physician and patient. The man who attempts to cure his patient by means of remedies in which he has no faith makes poor work of his attempts. And the patient who comes to the doctor without faith usually bears away with him the same ailments with which he came, intensified, it may be, a hundred fold. How often have we been shorn of our power to heal by the perverse unbelief of the sufferer. Doubt and fear paralyze the efficiency of remedies that might otherwise assert their curative virtue.

That there are valuable means of cure resident in the psychic realm many of us are fully persuaded. We have dogmatically set limitations upon their efficiency by our hampering skepticism. We have not been willing to give them a fair opportunity to demonstrate their powers. But we are becoming more rational and liberal. We are approaching a state of toleration which is most encouraging. I wish we knew better how to utilize the esoteric forces; but we are slowly learning. Those who know the least about a subject are often the most voluble in their denunciation of what it stands for. There can be no rational objection to a tentative adoption of methods that the experience of others has commended, no matter how new and problematical their nature, provided, of course, that they be not hazardous in themselves and do not displace those that are known to be measurably helpful.

Let us set for our motto in the realm of mind and morals this rational sentiment: *In certis unitas; in dubiis libertas; in omnibus caritas*.\* It is safe to do so, and it is just.

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\*In certainties unity; in doubtful things liberty; in everything charity.

## Radium, a Name Only.

BY J. RUDIS-JICINSKY, A. M., M. D., M. E., CEDAR RAPIDS, IOWA.

Ever since the wonderful discovery of the kathode rays by Zenger in 1884, the Becquerel rays in uranium, the Roentgen rays with their penetrative power for skiagraphy and therapy in medicine and surgery, the dark rays found by Le Bon, canal beams, Leonard rays, and the N rays; the discovery of Strutt, who proved beyond a doubt that all the metals are ionizing the air, and the discovery by Ebert that the air in the ground is more capable of carrying electric charges than ordinary air; scientific men have tried to answer the puzzling question what these and similar rays really are. Theories upon theories have been given, and these with the discovery of radium by Professor and Madam Curie, and the work of Be-mont, have had such wide-embracing consequences that today thru the epoch-making investigations of Thompson and others we are facing many new and startling problems.

What is radium? They say that the name is given to a new elementary substance recently discovered, as stated above, and that it has the peculiar property of continuously emitting radiations, some of which are of a similar character to the x-rays. The metal uranium, and pitch blende, the ore from which it is obtained in very minute quantities, has also properties very similar to those of radium, but in much less pronounced degree. The extraordinary properties of radium have given rise to much discussion as to the ultimate constitution of matter, and the old laws of chemistry, physics and physiology seemed to be shattered at once. But they are not dead, they are here yet, better understood with all the flood of light thrown on these broad regions of hitherto inexplicable phenomena.

It will be well perhaps to begin with electricity. What electricity is we simply do not know, but we do know what to do and how to do it to get the greatest and most useful amount of the same for our purposes. We have here the name for some kind of energy, an energy which thru the medium of ether gives us radiation, motion, heat, or a sensation caused by the action of ether-waves on the eye, namely light. We know that a certain energy must be imparted to the radio-meter-vane by the sun. To the sense of touch it appears to be heat, in the eye it produces the sensation of light, and in certain substances it has the power to produce chemical changes. Those chemical changes under the radiation from the sun have been going on for years and years on our earth, and we know that what we receive from the sun, whether it affects the sense of touch or sight or produces chemical changes, is in reality some form of energy and is one and the same form whatever the effect.

There is a class of substances which during several hours' exposure to light waves absorb their energy without becoming hot, and in turn emit light waves which are quite perceptible. This property of shining in the dark after having been exposed to light we find in decayed wood or over swamps. There where the atoms are crumbling and decaying, the decay itself seems to give us under the influence of the sun some other energy, perhaps some other life.

Madame Skłodowska-Curie found that the residue of pitch blende (certain remnants of silver ore from Jachymov, Bohemia), an oxide of uranium, after extracting the uranium, was four and one-half times as active as uranium. She

fused these residues with carbonate of soda, treated with acid, precipitated with sulfuretted hydrogen, and so on; the guiding principle being that while the chlorid of the substance was soluble, the sulfate was insoluble; and she received a light brown powder, which slightly darkens in hue as the radio-activity increases thru higher refinement, radium bromid. The whole process is most assuredly chemical.

Apart from the heat rays three distinct kinds of radiations are constantly evolved from radium, the alpha, beta and gamma rays. The gamma rays are analogous to x rays, the beta rays are less penetrating, and alpha rays have exceedingly slight penetrating power. Briefly, the projectiles from radium are material, heat and electricity; while x rays possess the shorter wave-lengths of electric discharges. Both are ultra-violet, at the end of the spectrum, with a slight deviation in the beam. Finsen's light, the electric light, is in the same category.

Now if we observe carefully a Crookes tube in the beginning of the action (as described in *American Medicine*, July 4, 1903), giving some x rays in the hemisphere proper, we will see the stream from the kathode of a light violet color and in the shape of a pencil bombarding the middle focal point on the platinum plate of the anode; then two peculiar lines of the same color will appear exactly at the division of the hemisphere of x ray activity and the dark hemisphere behind. In a few seconds, the apparatus giving a small amperage only, the violet color of the kathode rays will fill up the whole space of the hemisphere of the x ray proper, and these will appear in their beautiful yellow-green color at once, when there is enough electromotive force behind the tube. This shows that the speed and division of the particles and corpuseles

in the kathode ray depend upon this electromotive force, and the number of corpuseles in the discharge depends upon the magnitude of the current going thru the tube. It is an electrochemical action pure and simple. There is some medium filling the space of the vacuum tube unoccupied by air, a medium by which motion can be communicated from one point to another. This medium has received the name of ether, as we know. Is it possible that thru the influence of this medium the kathode rays are changed into more powerful rays of x ray order when there is more force and energy behind? If that is the case, the larger amount of energy in the ground-air, more capable of carrying electric charges with all their dynamic and chemie actions from the simplest decay to another animal or vegetable life, is due to electrons, the basic material out of which all matter is formed. The electrons are positively charged with electricity, and are the smallest particles known to be so charged. They are defined as the center of convergent ether strains. Ether then is the fourth stage of matter. Now we say ether, because we do not know more than that an empty space can not communicate motion. It is an unavoidable assumption, such as we make about the x rays, N rays, radium, etc., to explain their peculiar behavior and actions.

We get the ultra-violet and violet rays from the sun, besides all the other rays of light. The force behind is not known to us. The force electricity we know that we have. Is it the same force which we get from the sun, or some part of it, which enters into chemical combinations, into all kinds of periodic disturbances in the ether, with most complex aggregations of components in different objects on the earth? Is light, are all the rays of light, the result of electrochemical action in a



vacuum around the world of ours, having all kinds of electrons between the poles, positively charged with electricity? Are we all probably but varied forms of ether? We know that the electrons move freely, and everything has a greater or smaller number of electrons about it; in other words, everything gives more or less light, and radium is the best illustration of it. Professor Sir William Ramsay has described experiments in which the emanations given out by radium appear to be transformed into the gas helium—again life and death with light and darkness.

One theory after another appears, all dealing with the unknown, and always with the same energy; at least an energy that is named today electricity, tomorrow ether, transformation, electrolysis, emanation or decomposition, matter in ultragaseous state, dissociation of the elements, etc., welded into a theory, which from the practical standpoint is a result of a certain chemical process bearing the name Radium, a name only.

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#### **X-Ray Photograph of Rubber Tube.**

Dr. J. F. Smith reported at a meeting of the Chicago Medical Society an investigation of the permeability of rubber drainage tubes to x-rays. The late Professor Fenger suspected that a drainage tube had been lost in the abdominal cavity of a patient. Before reopening the wound experiments showed that a red rubber drainage tube gave a distinct shadow through the tissues of the body. A skiagraph of the patient proved in this case the absence of the tube. Rubber containing vermilion (mercuric sulfid) casts a dense shadow. Rubber containing sulfid of antimony and compounds of lead or zinc cast shadows which are less dense. The shadow of pure gum is scarcely perceptible thru any thickness of tissue.

#### **Therapeutic Uses of X-Rays.**

In the *Virginia Medical Semi-Monthly*, November 13, 1903, Dr. E. G. Williams, Richmond, Va., reviews the history and technic of x-ray treatment and gives a number of cases. "In treating cases my object is to use a ray that will penetrate just beyond the diseased conditions." Idiosyncrasy is of small importance. The effects of the rays upon normal tissues he finds to be in close accord with theory, and the therapeutic effects can be depended upon to the extent indicated by theory. The indications for the use of x-rays are bactericidal, stimulative, destructive and anodyne. The bactericidal action is useful in parasitic diseases; the stimulating action in chronic conditions, alopecia, rosacea, etc.; the destructive action in those pathological growths in which the abnormal cells are of much lower vitality than the others; and the anodyne effect is marked in malignant growths and neuralgia.

He reports six cases of epithelioma cured; one case of carcinoma of the face cured and another doing well; one carcinoma of the ear nearly cured; a submaxillary carcinoma improving; one case of recurrent carcinoma of the breast nearly cured, and one died with numerous metastatic growths in liver, kidneys and other organs; one case of acne rosacea of nose, redness disappeared, but the dilated capillaries persist; two cases of psoriasis cured; lupus erythematosus on nose, cured; case of locomotor ataxia is very much improved.

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#### **Keloid Treated by X-Rays.**

Dr. William M. Harsha reports in *Medical Journal*, of January, the marked reduction in size of a keloid growth behind the right ear in a man of eighteen.

## Electro Therapy.

A Course of Twenty-four Lessons under the auspices of the Chicago College of X Ray and Electro Therapeutics.

### Lesson 11—HIGH FREQUENCY CURRENTS.

The discharge from a Leyden jar is oscillatory when the resistance of the discharge circuit is small. The period of the oscillation varies under different conditions, one of which is the capacity of the jar. An electric charge is a strain of the atoms and the ether in and about the dielectric of the condenser, a twisting strain of the atoms of the glass of the Leyden jar, according to the vortex theory. When the capacity of the jar is small there is a relatively small number of atoms to be twisted, and the total amount of twist produced by a given force is small. The untwisting, which constitutes the electric discharge, takes place with great rapidity, and the time of each oscillatory wave is exceedingly short, perhaps one hundred-millionth of a second. Each wave of the series has less amplitude than the one before it, so that the whole series may be over in less than the millionth of a second. When the capacity of the Leyden jar is greater the untwisting occupies a much longer time, and the frequency of the oscillatory waves is proportionally less.

When two Leyden jars are used in connection with a coil or static machine one of them is charged negatively and the other positively. The connection of the outer coats of the two jars places them in similar positions in the same electric circuit so that both in the charge and in the discharge the oscillatory currents and these only traverse the conductor connecting the outer coats of the jars.

It is essential to bear in mind these first principles of electric currents, that they do not flow at all except in complete circuits, and that the total current in every cross section of a complete circuit is the same. The glass of the Leyden

jars is a non-conductor, yet it forms in this case part of the conducting circuit. A non-conductor is a substance whose atoms can not rotate continuously under an electromotive force without tearing them apart from their fellows and thus destroying the substance. But all non-conductors are dielectrics, that is to say, they are capable of conveying the electric twist to some extent from atom to atom thru their substance. In other words, the atoms in a non-conductor can rotate a little way, the strain becoming greater with the increase of force, and may oscillate back and forth so as to become to a limited degree conductors of an alternating current. The circuit of a direct current must consist of conductors only, or of conductors and such dielectrics as become conductors under the given conditions. But the circuit of an alternating current is not necessarily so restricted.

The oscillatory current in that part of the circuit between the two Leyden jars is almost always used as the basis of the high frequency currents used for therapeutic purposes. In order to secure the best results each jar should have a condensing surface approaching one square foot in area, and the two jars should be tuned to the same capacity. The break in the primary current must be sharp and clean, and the primary current must be sufficient to charge the condensers promptly and completely.

The high frequency discharge of the jars is not directly available therapeutically, because to pass it thru the body means to put into the circuit so much resistance that the oscillations are prevented. The oscillations of a tuning fork may continue for several minutes in air, since the air offers so little resistance that the

energy of the oscillation is dissipated slowly, but if the resistance to the motions of the fork be increased, as by touching it with a feather, the motions die out rapidly, while if the resistance be still more increased by pressing a finger on the fork the oscillations are prevented entirely. Electric oscillations are affected in a similar way by an increased resistance in the circuit.

On this account the resistance of the Leyden jar circuit is kept small by making the conductors of relatively short and heavy wires, and the therapeutic currents are produced from these by one of the following methods:

The wire from the jars is made into a helix or a spiral, from each end of which comes a branch wire to the electrode. The two branch wires together with the body of the patient form a shunt or branch circuit, whose resistance is many thousands of times greater than the resistance of the helix or spiral. Consequently a steady current would pass almost entirely thru the helix, leaving nearly nothing for the shunt. But with a sudden impulse this is not the case. The self-induction of the coil retards the first impulse for the minute fraction of a second, and the full electromotive force of the discharge is available to send this impulse with its succeeding waves thru the shunt circuit, of which the patient forms a part. The main part of the current, however, coming an instant later, passes thru the coil, and its oscillations each have their tips sent into the shunt. These are sometimes known as d'Arsonval currents. Their properties seem to be quite different from those of ordinary currents. For example, the two electrodes may be held in the bare hands with scarcely any sensory evidence of a current, but when the electrodes are brought together a series of strong and bright

sparks appears in the air between them, and if the metallic electrodes are touched together they adhere quite strongly, owing possibly to the heat generated by the current at the point of contact by the heavy current then passing. Muscular contractions may be produced in any part of the body by placing the electrodes upon the surface in such positions that the resistance of the shunt circuit is small, even if the uninsulated electrodes are at the same time held in the hands. In such case more of the current passes thru the shunt and less thru the coil, while so long as the shunt resistance is high only the tips of the oscillating waves pass that way.

A second method of obtaining high frequency currents that are available for therapeutic uses consists in the use of a small inductorium for transforming the oscillations into others of the same period but of higher potential. For this purpose the wire from the jars is wound in a rather open helix, so as to avoid self-induction, and within this and insulated from it is placed a secondary helix of much finer wire with perhaps ten times the number of turns, not too closely wound. Each set of oscillations of the current in the primary wire of this transformer (which is usually known as a hyper-static) produces by induction a similar set in the finer secondary wire. The two helices must be properly tuned so that their natural periods of oscillation are in harmony, and it is a curious fact that unless this tuning is perfect better currents are obtained by using only one terminal of the secondary than by using both, because the waves interfere and partly neutralize each other.

The principle of resonance is made use of as a third method of obtaining high frequency currents of high potential and great intensity. The Oudin resonator is a large helix of heavy copper wire, rather



heavier at the base than above, very openly wound so as to avoid self-induction. Thru a few of the heavier turns of this helix the impulses from the jars are passed. The upper part of the coil then becomes the seat of high frequency oscillations of much greater potential, or in other words it is the seat of oscillations of much greater amplitude, which are like the current from the hyper-static in seeming not to have a circuit but to come from one terminal only. These electric oscillations correspond to the oscillations of the tip of a fishing rod when the handle is held in the two hands and strongly shaken. When the shakes are properly timed to the length and elasticity of the rod its tip makes much larger vibrations with much swifter motions than those of the part held in the hands.

The Oudin resonator, when properly

excited by a heavy current from a coil or static machine, is capable of giving a torrent of sparks or a blue spray (effluve) four to six inches in length. From a pair of resonators properly tuned a spray may be made to pass between two electrodes nearly a foot apart.

High frequency currents can not be measured satisfactorily with an ordinary meter. The dissipation of energy in a conductor is measured, but this rate increases with the frequency of the current. The current from a resonator may register 300 milliamperes or more and be perfectly harmless, while one third of that current actually passing thru the body would be dangerous to life. But so long as the frequency is the same the meter serves as a relative measure and is therefore of considerable service in giving treatments.



#### High Frequency Currents in Medicine.

In *The Medical Visitor* for December, Dr. E. H. Grubbe gives a popular exposition of this subject and makes, as is very frequent in popular papers, a few inaccurate statements, such as these: "Electric vibrations differ from other forms of vibration only in rate and number." "The simplest form of the electric vibration is the direct or continuous current." As a matter of fact, vibrations differ in kind as much as they do in frequency. A direct current is not a vibration at all. The words "direct" and "continuous" are not synonymous terms; a direct current is one which goes in one direction only; a con-

tinuous current is one that keeps on without interruption.

#### Action of Light on Germ Diseases.

*The Electrical Review* suggests the theory (Jan. 2, 1904) that the germs of diseases which are favorably affected by radiations may be of a size somewhere near the wave length of the ray which affects them, and that they are injured or destroyed by the electric currents set up in them when the tuning is accurate. Possibly the physician of the future will screen off all the other rays and use only those which are destructive to the germs of the disease which he is combating.



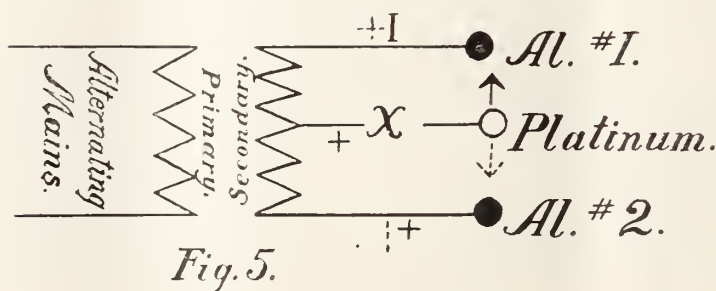
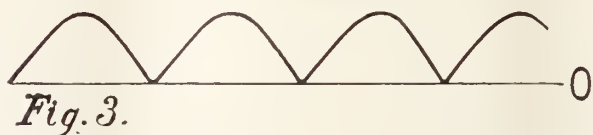
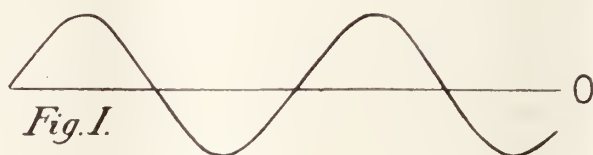
# A New Alternating Current Rectifier and Interrupter.

BY W. B. CHURCHER, M. E.

CINCINNATI, OHIO.

The principles underlying the aluminum rectifier have recently undergone a process of development that makes this device a practical piece of apparatus. For the benefit of those unfamiliar with these fundamental principles the simplest type of rectifier will be first described. An aluminum rod when connected to the pos-

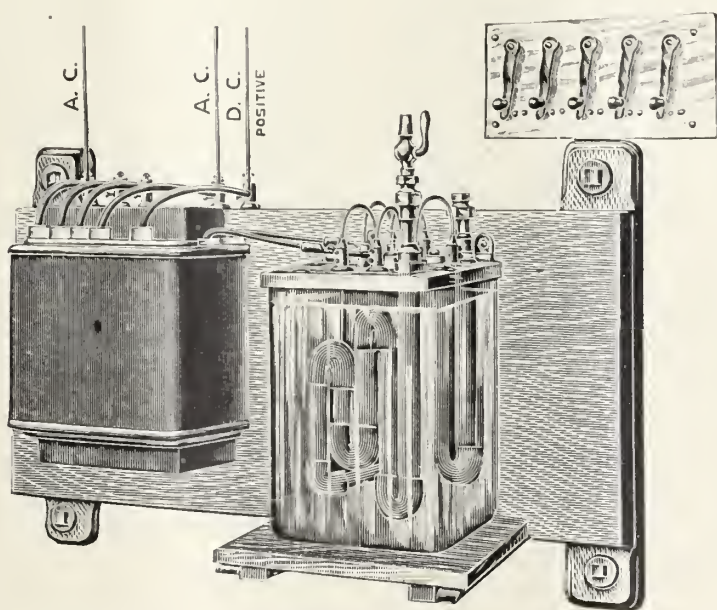
itive side of a source of direct current and immersed in a phosphate of soda solution with said solution in contact with another electrode, say of platinum, which is connected to the negative side of the same source of current simply, will develop upon its surface a film that almost completely insulates the aluminum from the



solution. When the current is reversed so that the aluminum is negative to the platinum the film permits the free passage of the current. If the current is again reversed the film at once insulates the aluminum from the solution. It appears to make little or no difference how rapidly these reversals of current take place, as the valve action of the aluminum remains unchanged. It will, therefore, be understood that an alternating current

simple rectifier as above described. The curve below the O line represents the current that "leaks" from the aluminum rod at the instant it becomes positive.

The Churcher Rectifier, which produces uni-directional current, is illustrated in Fig. 3. This is accomplished by the aid of two aluminum electrodes instead of one, both in the same solution with the platinum electrode. This method of rectifying requires the use of a transformer



of any frequency will operate the "valve." At the instant the aluminum rod becomes positive a small momentary current does pass from the aluminum to the platinum thru the solution, but only during the actual closing of the "valve." Therefore a complete rectifying of the current can not take place when one aluminum electrode is used. Fig. 1 illustrates the ordinary alternating current wave and Fig. 2 illustrates the wave as produced by the

having a center tap in the secondary winding (Fig. 5). The two extreme terminals of this secondary are connected to the two aluminum electrodes in the rectifier solution (Fig. 5). It will be readily seen that when No. 1 aluminum electrode is positive No. 2 aluminum electrode is negative. When reversal takes place No. 2 electrode becomes positive and No. 1 negative, etc., etc. When No. 1 electrode is positive its film insulates it



from the solution so that the half of the transformer connected to it can not act. No. 2 aluminum electrode being negative, current passes from the center tap of transformer to the platinum and thence thru the solution to aluminum electrode No. 2. At reversal of the current the reverse action takes place, so that the center tap of the transformer is positive at all times to one or the other of the aluminum electrodes producing a current as in Fig. 3. The apparatus (X) to be operated by the uni-directional current is to be connected in circuit between the center tap of the transformer and the platinum electrode. The leakage of current before mentioned still takes place, but passes to the negative aluminum electrode instead of to the platinum electrode and hence does not affect the apparatus at (X).

The primary winding of the transformer can be readily adapted to any alternating current line and the secondary can be wound to deliver any voltage or amperage of direct current. The regulation of the direct current from the rectifier is best attained by regulating the primary alternating supply by means of inductance or resistance.

The Churcher Alternating Current Rectifying Interrupter is constructed upon

the principle above described, but has restricted area of platinum electrode exposed to the solution. If an x-ray coil having comparatively few primary turns of low resistance be connected in circuit at "X" a sufficient volume of current will flow to completely interrupt the current at the platinum electrode. There may be a number of these electrodes of different areas so that by the selection of any one or any combination of two or more a wide range in volume of spark and rapidity of interruption may be obtained. This interrupted current always flowing in one direction produces results in the x-ray tube similar to those produced when ordinary direct current is used. In fact, the results are superior to the extent that the interruptions can not take place as rapidly because of the wave form of the direct current. The interruptions can take place only during or near the peak of the pulsating (not alternating) wave from the rectifier, or approximately with one-half the frequency when direct current is used. Fig. 4 approximately illustrates the interruptions from this type of alternating current interrupter. Fig. 6 illustrates the complete rectifying interrupter.



#### Light Rays for Tuberculosis.

Dr. C. E. Rogers, in the *St. Louis Medical Arena* for December, says the germ-destroying power of light is not directly dependent upon its quality, but upon the quantity. The quality is only important as a factor in reaching the diseased parts. He finds the combined rays much more penetrating than the violet or ultra violet. Recovery from pulmonary tuberculosis is possible even in advanced conditions. It

depends as much upon the general condition of the patient as upon local treatment. The exposures to light must continue at least an hour at a time, and sometimes a period of ten or twelve hours is required for a single treatment. His results have been good. The shortest period of treatment followed by cure was one month, the longest six months, the average ninety-eight days.

## A Study of Light—Ultra Violet Light.

BY J. MOUNT BLEYER, M. D., F. R. A. M. S., LL. D., OF NEW YORK CITY.

*(Continued from page 32, January, 1904.)*

The fluorescence spectrum received upon the fluid shows, as I have already mentioned, three regions of stronged fluorescence, and the absorption spectrum of naphthaline, which by placing a small cell filled with the solution in front of the slit may be obtained upon a paper screen, gives a key to the cause of this phenomenon. In this spectrum (see p. 25) a completely black band is visible in the green-yellow band D, a dark band between E and b, while the violet end appears shaded. On employing a very small solution of the naphthaline coloring material the whole spectrum vanishes, with the exception of the red end, which remains apparent to a point behind C. If, now, the absorption spectrum be compared with that thrown upon the fluid, the intimate relations between the absorption and fluorescence, that has already been pointed out in the esculin solution, is corroborated in the minutest particulars, for every dark band in the absorption spectrum corresponds to a bright band in the fluorescing spectrum. Every ray absorbed by the fluid occasions fluorescence, and the fluorescent light produced is the brighter the more completely the ray is absorbed.

A second example of the excitation of fluorescence by rays of small refrangibility is exhibited by the solution of chlorophyll. The spectrum projected upon this green fluid fluorescence of a dark red color from B to a point within the ultra-violet, exhibiting at the same time bright bands which correspond with the dark bands in the absorption spectrum between B and C, where the greatest amount of absorption occurs, the fluorescence is also the most marked; but it is the middle red rays which here act so powerfully as excitants. It is remarkable that the red

fluorescent light which the chlorophyll solution emits likewise lies, in regard to its refrangibility, between B and C. Chlorophyll solution affords a proof that all rays of the spectrum, with the exception of the extreme red in front of B, are capable of calling forth fluorescence. Their capacity for doing so depends simply on the power of absorption of the fluorescing substance. The most refrangible violet and ultra-violet rays are, however, characterized by the circumstance that they are capable of exciting all known fluorescing bodies.

Fluorescent light is only perceived so long as the fluorescent substance is illuminated by the exciting rays; as soon as the light falling on it is obstructed, the colored shimmer vanishes. It is only in the case of some fluorescent solid substance, as, for example, fluor-spar and uranium glass, that, with the aid of appropriate apparatus (Becquerel's phosphoroscope) a very short continuance of the fluorescence may be observed to take place in the dark.

There are, however, a number of bodies which, after having self-luminosity excited, continue to shine for a certain time in the dark. These substances, and the physical cause, I have already alluded to in one of my published papers, to which I refer you.

I will devote the rest of this paper to demonstrating some of the photographic qualities of light waves.

I begin with a piece of common "printing-out" paper—in other words, paper that has already been covered with a sensitive film saturated with chlorid or bromid of silver that turns almost black after exposure to light for a certain time. I cover a portion of this sheet of sensitized

paper with stencil plates cut out in sheet zinc and then subject it to the white light proceeding from an electric arc lamp placed near by. In thirty seconds you can see on the already darkened paper where the light waves, falling on the exposed parts, have performed their chemical action and printed patterns of the stencils. And at this point arises the question—which, of all the rays, actinic, calorific and visible, that have been permitted to fall upon the paper, was the actual ray that produced the given result? We will prove this by a simple test, by turning on the light in the optical lantern and utilizing the quartz lenses and prism to produce the spectrum. We now stretch out a long piece of “printing-out” paper along the entire length of the visible spectrum to a distance into the invisible spectrum at both ends and leave it there to develop. In a few minutes I shall refer to it again.

I take another sheet of “printing-out” paper. Over it I place a sheet of opaque tinfoil, in which a number of holes have already been cut. These holes I cover with a number of thin pieces of different materials—for instance, 1. window glass; 2. flint glass; 3. red glass; 4. green glass; 5. blue glass; 6. quartz; 7. fluor spar; 8. rock salt; 9. ebonite. I now pass the sensitized paper so covered under the rays of an electric arc lamp, placed so as to throw all its light downward. Since the paper can be darkened only under those materials transparent to the photographic rays, it will naturally appear at once which materials cut off the active waves. Two minutes’ subjection to the light will give the test.

You will see at the end of that time on taking up the sheet none of the photographic rays have been transmitted by the red glass or the ebonite (itself black);

whereas the green glass has held back the greater part of them, while the flint glass has transmitted only a few; you will notice now that beneath the quartz, the rock salt, the blue glass and the window glass the paper appears to have darkened in about equal degrees—al tho by applying a more powerful test we could find degrees of difference among even these. One practical fact at least has been proved by this test, that, al tho red light affects our effect, it produces no effect whatever upon a photographic film. Every photographer shows that he has observed this by using red-colored tissue or red glass to screen the light he uses while preparing and developing his plates or to cover the windows of his “dark room.”

I now return to the long strip of sensitized paper that has been during this time exposed to the spectrum. On examining it, it is apparent that it has preceptibly darkened at the violet end even beyond the end of the visible violet, and beyond even into the region where our plain eyesight can see nothing. In fact, the photographic spectrum lies, for the most part, beyond the violet, the most active waves being than those visible. Nevertheless, it is a fact that the rays of sensitiveness can be altered by the use of other chemical preparations. To Captain Abney science owes the discovery of emulsions of bromid of silver in films of gelatin, so prepared as to be sensitive not to violet or ultra-violet light alone, but to green and yellow as well and even to red waves.

Another very interesting experiment shows what chemical result light waves can produce is to induce mixed hydrogen and chlorine gases to combine. These gases (prepared by electrolysis of hydrochloric acid) may be kept mixed in glass bulbs for any period, if kept in the dark, and provided they are not chemically com-



bined. If subjected to the diffused light of a room, they combine slowly; if subjected to direct sunlight or to the light of an electric arc lamp or ultra-violet tube, they combine with great violence and explode the bulb. And here again comes the question—which part of the light is it that gives the results? Assuredly, not the red waves, since, if protected by red glass, these bulbs of mixed gases may be freely subjected to light. Therefore, the active ray in this case is the ultra-violet.

Take a thin glass bulb containing the mixed gases that has been carefully kept in the dark. To avoid any accident, we place it into a lantern, into a nozzle of which we will direct, from the outside, the rays of an electric arc lamp, or ultra-violet tube. To direct away a great part of the ordinary rays, I first place between them a sheet of violet glass that allows of some violet and very few ultra-violet rays to pass. Then, interposing a quartz lens, I concentrate the ray upon the bulb, when—bang—it explodes, showing the marvelous activity of waves of this kind. If the ultra-violet vacuum tube is used an almost immediate explosion takes place, whether screens of glass are interposed or not.

It may possibly have occurred to you that if so marvelous a photographic activity belongs to waves that are invisible to the naked eye, it should be possible to photograph the invisible, and, in fact, it is.

About twenty years ago the veteran chemist, Dr. J. Hall Gladstone, lectured here on the photography of the invisible, demonstrating how he himself had been successful in photographing figures of things absolutely invisible to the human eye. The demonstration of this remarkable fact is very simple. I place against

the wall a drawing board, over which I have placed a white sheet of cartridge paper, with the light of an arc lamp shining on it. Only a plain white surface can be seen. We will now photograph it. When developed, the photograph will prove that an inscription was written, which, altho not visible to you, was readily photographed by the camera.

The inscription was written on the sheet with colorless sulfate of quinin dissolved in a solution of citric acid. This substance fluoresces, and in the act of fluorescing destroys the ultra-violet light, which would otherwise be reflected from the paper so treated. The parts where the sulfate of quinin has been applied consequently come out on the photographs darker than the untouched surface of the paper.

Since photographic action has proved to us that even with the lack of every kind of apparent visible light it can still succeed in detecting these ultra-violet rays, it will be necessarily a factor in further researches into the qualities and properties of these invisible waves.

As wave length is one of the properties that has great bearing upon the subject with which I am dealing, I propose to refer to this in some detail. If we consider a wave of light in its simplest form, we imagine a disturbance consisting of a uniform succession of crests and hollows, and a luminous radiation will extend as an unbroken succession of such crests and hollows from the point of origin to the place where they are absorbed and converted into some other form of energy. These two points (crests and hollows) may be separated but a few inches in laboratory experiments, as I will show here in the form of spectrograms, or any number of millions of miles, in the case of light from a distant star. So we know

that a wave length is the distance measured from crest to crest, and is expressed in units of a scale of millionths of a millimeter.

I have already spoken of the different wave lengths of vibration, telling you how our sense of color depended upon them, the shorter waves producing what we call violet light, and the longer ones red, the intermediate giving blue, green, yellow and orange. Nevertheless, I repeat here, so as to be perfectly clear in regard to what I have to say: Radiations of this character are not confined to the limits of our vision, but extend beyond the red in a series of increasingly long waves, constituting what is called the infra red region, and beyond the violet in a series of increasingly short waves, constituting the important ultra-violet region, which is of present interest to us.

This diagram I present here will help to clear up the mistaken ideas in connection with ultra-violet rays and those more refrangible. Those rays that are in the visible region are between 435.8 and 759.3 units; below this latter limit evidence has been obtained by Prof. Langley of radiations with a wave length of over 5,300 units, and in the ultra-violet region the researches of Victor Shuman, of Leipsic, have resulted in the photographic record of waves as short as 120 units. Mr. Shuman's work on spectrum photography is well known and needs no introduction, as it is appreciated by all who have made of spectrum analysis a study.

More than twelve years ago he demonstrated the remarkable absorptive effect of air upon very short vibrations, so great, indeed, that even the air within the tubes of the spectograph was a serious obstacle to the investigation. We find that the very short waves do not reach us from the sun, being absorbed by the atmosphere;

in fact, a few inches of air even will absorb them on the outside. I am, however, of the belief, from practical therapeutical tests and my large experience with light, that these ultra waves are of no value by themselves, so let us not worry over them and their scarcity of production. I am firmly convinced that from the mixed rays within the bounds of the scale from 500 to 300 our best therapeutical results will be gotten. These may even be found later on to vary, as we are still much in the dark as to the exact action of each, whether separate or combined.

Mr. Shuman, with all the obstacles that confronted him, however, was able with the apparatus then at hand to demonstrate the existence of lines up to and beyond the wave length 185 units, using the light of the aluminum spark.

Mr. Shuman's ingenuity, which has characterized all his work, has since constructed a spectograph exhausted of air, with lenses and prisms of white fluor spar. The source of light for these researches was the hydrogen Geissler tube. With the exhausted spectroscop, as it is termed, and photographic plates of ultra sensitive kind, he finds the photographic action of the spectrum beyond the wave length 185 very strong. Indeed, it is composed of fourteen lines, including altogether about 600 lines. The boundary of this hitherto entirely unknown portion of the spectrum extends about four times as far from the most refrangible line hitherto photographed (the aluminum line 185), as that line is beyond the blue hydrogen line of wave length 486. The interest of these researches is, therefore, very great, and it seems as tho the limit of the radiations might only be reached when we can detect them in the universal ether itself. unaffected by a trace of an absorptive

medium and with the photographic plates of ultra sensitiveness.

The regular photographic plates that we employ in usual work do not serve for this class of spectrum photography, but there are plates of which Mr. Shuman speaks, and used by himself, possessing peculiar sensitiveness to ultra-violet rays, but relatively very little to the light of the visible spectrum. Because of this insensitiveness to the visible spectrum, the plate acts toward the ultra-violet precisely like one exposed to filtered light, from which all the rays have been absorbed, which, as diffused light in the spectrograph, would tend to cause fogginess of the picture. Such is the effect when an attempt is made to photograph the ultra-violet spectrum with an ordinary plate; for, before the ultra-violet rays have affected the plate, or produced a distinct image, the plate is fogged all over by the diffused lights. This, however, is not altogether true, as I have gotten the spectrum of the ultra-violet light on ordinary photographic plates without altogether producing fogging, tho not such a large spectrum as Mr. Shuman speaks of. I am fully in accord with his experiments from what my experience has taught me in spectrographing the ultra-violet rays.

I find that the vacuum ultra-violet tube (Mount Bleyer's) shows on its spectrogram a test that gives equal penetration thru glass as without it. Any screen of glass interposed between the spectroscope and the vacuum ultra-violet tube, while taking a spectroscopic photo of the ultra-violet light, will be found not to hinder the passage of the ultra-violet rays. Whereas, if the same process is again repeated in photographing the ultra-violet ray of an arc or electric spark of any kind in the open air, and any kind of a screen of glass, paper, paraffin paper or other

such materials be interposed between the spark and the spectroscope, excepting quartz, the ultra-violet ray is cut out by such screens as here mentioned. However, we find that electric sparks give a large size ultra-violet ray spectrum on the photo, if taken without the interposition of any screens whatsoever.

It is worthy of note, according to the many hundreds of practical demonstrations that I have made, photographically as well as otherwise, that the sparks lack the penetrative quality, but gain in quantity of light, as compared with the ultra-violet rays which are generated from a vacuum tube. These vacuum tube ultra-violet rays have more diffusion, less concentration and more penetration; while the electric sparks and arcs possess greater ultra-violet rays on account of their concentration, but lack penetration. All this is easily proven by spectroscopic photography and allied experiments.

#### SOME IMPORTANT FACTS ON LIGHT RAYS OF SMALLEST WAVE LENGTH.

For a long time wave lengths of two lines of the aluminum spectrum were considered the shortest. According to the measurements made by A. Cornus, the length of these lines in Angstrom units (one A. = 0.0000001 millimeter) were 1,860 and 1,851 A. U.

It is absolutely impossible for the human eye to discern the lines or even the entire spectrum region of the ultra-violet. The privilege is reserved for very few to observe the ultra-violet through the ocular of a sufficiently transparent spectrum apparatus as plainly as the less deflected region of the visible spectrum, which, as we know, can be observed by any sound eye. The ultra-violet light can be made visible only in an indirect way—either by projection upon a fluorescent screen, or by



photographic fixation upon a sensitive plate.

The spectrum of fluorescence can be observed directly or through a lens; in either case it will lack definiteness and clearness.

Formerly when the photographic plate could be developed only by liquids and the present dry plate was unknown, the fluorescence spectrum was often used in experiments with ultra-violet rays. At present, with the advantages of the bromid of silver gelatin plate, no one would think of employing the imperfect fluorescence spectrum.

The photographic method of observing the ultra-violet light has replaced the directly ocular. Anyone who has used both will agree with the following statement: The fluorescence spectrum is much too crude and insufficient for modern exact spectroscopy.

The modern dry plate is found to be more sensitive to the ultra-violet rays, and this greater sensitiveness greatly promotes the exactness of spectrum investigations.

The same shows its greatest sensitiveness to all light sources of electric origin, not in the visible spectrum, but remote from this in the ultra-violet.

In photographing the spectrum of any metal spark, the ultra-violet is always the first to develop, and only after longer exposure will the visible spectrum appear. But it is by no means the whole ultra-violet light that distances the visible. Only a part of it possesses this photographic superiority.

All the light that works efficiently beyond the cadmium line 24 requires for reproduction considerably longer exposure. The sensitiveness of the plate decreases visibly from this line (its wave length = 226.6) with the deflectibility of the rays, and with the employment of

large photographic apparatus it sinks, at about 200 wave length to zero.

Approximately, therefore, 200 would be the smallest wave length that can be observed thru the usual large grating apparatus.

Experimenting at this limit of efficiency with a small photographic apparatus, the domain of observation becomes considerably extended and the usual bromid of silver gelatin proves—with sufficiently short focus and transparency of the optical body—serviceable down to 182 wave length.

This relative limit of smallest wave length was decided by thoro experiments in 1890 by Schuman, with an apparatus of 180 min. focus (Fraunhofer line D.).

The fact that the spectrum of photographic efficiency runs the farther into the ultra-violet the shorter the focus, shows plainly that the limit of photographic efficiency is connected with the density of the air stratum that the rays must traverse on their way to the photographic plate.

If we, starting from this fact, try to further decrease the air strata, we shall observe that the photographic efficiency recedes still a few lines of smaller wave length, yet the increase in length of the efficiency strip is so insignificant as to be out of proportion with the labor and expenditure for such a small spectrograph.

It therefore seems that in this the true limit of perceptible rays of smallest wave length is reached.

In this we are confirmed by the fact that the fluorescence-spectrum disappears much sooner, at wave length 185, and that it is therefore useless for the observation of all more widely deflected rays.

If we did not have at our disposal the photographic plate, but only the fluorescent materials, the smallest perceptible light wave would be 185.2.

We see from this that both extreme values are true only proportionately or relatively.

Similar to the fluorescent substance, that ceases to light from wave length 185, possibly the photographic plate might be incapable of receiving impression possible of development of all rays with wave length below 182.

This reflection guided Shuman when he was not successful in making extensive experiments two years before with rays of the most deflexible ultra-violet.

He found that it was only lack of sensitiveness of the plate employed, and by no means the insufficient energy of the light rays, that stood in the way of satisfactory results beyond 182.

He furthermore found that the rays were "choked" already in the gelatin cover of the sensitive silver core before they arrived at the disintegration of this substance.

It was the gelatin that lay at the bottom of my failures to photograph extreme ultra-violet.

This important discovery led him to the preparation of a new plate, which was better suited for photography of all rays below wave length 226 than the gelatin plate previously used.

The new plate acts entirely differently toward the light rays from the gelatin plate; little sensitive to all rays of the visible spectrum and the less deflected ultra-violet rays, it increases in its sensitiveness from 226 to about 186. At 186 the plate seems to have the greatest susceptibility for light impressions, at least from electric light sources, as others do not create so strongly deflected rays.

Further toward the deflectible side the sensitiveness decreases somewhat; yet wave length 182, marking the limit for the sensitiveness of the gelatin plate, has

no intercepting influence; strong and clear in outline even beyond 182 it will render the spectrum efficiency-strip.

If the spectrum apparatus works with a prism then it appears as if the light masses emerging from the fountain, otherwise withheld from the eye in eternal night, would never end.

With every additional region introduced for photography are things to attain the limit of smallest light rays.

But it seems that the smallest wave to be photographically fixed flees the faster into the extreme ultra-violet, the closer the chain in the shape of the sensitive plate approaches. Schuman's new plate shows already beyond 185 a spectrum strip, that distances the whole efficiency of the bromid of silver gelatin more than three times in length, but the last of my exposures allows me to hope that beyond the edge of this plate there is yet light of photographic efficiency.

The photography of the neighboring region is meanwhile obstructed by obstacles that, if at all, can be removed not without difficulties.

Photography in a vacuum presents some difficulties and requires far greater care than under ordinary conditions. Even under the most favorable conditions the photographic effect of these extremely refrangible radiations is relatively so very weak that on many plates prepared according to some of the best methods it is found difficult to establish the existence of the vibrations of the shortest wave lengths. Mr. Schuman found this fact also in his own experiments, and cites it as such. This is a fact and bears me out, since I have found that the light emitted from a vacuum tube is too dim when compared with electric sparks or electric arc. There is not enough quantity of light present to act upon the photographic plate as when

a spark or the arc is made use of. Nevertheless, this fact remains that all spectrograms of the ultra-violet light show even on ordinary plates that the penetrative quality of these rays from a vacuum tube is shown in full detail. I am certain from my observations and those of Mr. Shuman that if special arrangements were made the vacuum spectrum would as far exceed the ultra-violet spectrum as that exceeds the spectrum from the electric arc spark.

His preliminary experiments in this direction are nearly finished, and are very promising. Under these conditions, he has named the length of the smallest light wave from his exposures only as an estimate and with reserve; it may not exceed 100, and might even be considerably shorter. To the wave length 100 corresponds an extremely high number of vibrations of the ether. While the most deflectible sun rays vibrate little more than 1,000 trillion times per second, a ray of the wave length 100 will vibrate 3,000 trillion times.

Hitherto the spectroscopist has not had to figure with vibrations of such frequency; and yet it may be possible to follow the effects of the light ether close to wave length zero when the finite will be hardly able to express the immense number of vibrations.

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**A New Radiation.**—Sanford writes in *Phys. Rev.* for December a long paper on an undescribed form of radiation. When the terminals of the secondary winding of an induction coil are connected to the plates of an air condenser, the condenser plate connected to the kathode gives off a peculiar form of radiation into the condenser field whenever the current is interrupted in the primary coil. If a spark is allowed to pass between the discharging knobs of the secondary, the radiation is

given off from both condenser plates; but when no discharge occurs it is given off only from the kathode plate. This radiation appears to be of the same nature as the ultra-violet radiation from a luminous body, and may be reflected, refracted and polarized like ordinary light. When it falls upon bodies placed in the condenser field, these bodies become sources of a secondary radiation very similar in its properties to the primary radiation by which it is produced. This secondary radiation may, in the case of metals at least, be given off both from the side of the body upon which the primary radiation from the kathode falls and from the side facing the anode. It may even be given off into an insulated hollow conductor placed in the condenser field. In addition to this secondary radiation, the metals may reflect the original primary radiation. The experiments made by the author are described at length. To explain them he says that had the experiments been carried on in the field of a condenser from which the air had been exhausted, the ordinary kathode radiation would have passed across from the kathode plate to the anode. Since this kathode radiation is believed to consist of negatively-charged electrons driven off from the kathode, it seems probable that the same electrons will be sent off when the space between the condenser plates is filled with air. In the latter case they are stopped by colliding with air molecules, while in the former case they are stopped only by the anode or the walls of the containing vessel. These electrons when striking against the walls of the tube or against metal plate contained in the tube, give rise to the Roentgen radiation, and it seems probable that their collisions with the gas molecules in the condenser give rise to the radiation described by the author.—*Elec. World.*



### Polarization in Roentgen Rays.

Some experiments have been made by Mr. Charles G. Barkla, in order to determine whether any polarization takes place due to Roentgen rays. As explained by Dr. J. J. Thomson, Roentgen rays consist of a succession of electromagnetic pulses in the ether. Therefore, each ion in the medium has its motion accelerated by the intense electric fields in these pulses, and consequently is the origin of a secondary radiation which is most intense in the direction perpendicular to that of the acceleration of the ion. If, then, a secondary beam be studied, the direction of propagation of which is perpendicular to that of the primary, it will, according to this theory, be plane polarized, the direction of electric intensity being parallel to the pulse front of the primary beam. It occurred to the author that as Roentgen radiation is produced in a bulb by a directed stream of electrons, there is probably at the anti-kathode a greater acceleration along the line of propagation of the kathode rays than in a direction at right angles. Consequently, if a beam of x-rays, proceeding in a direction perpendicular to that of the kathode stream, be studied, it should show a greater electric intensity parallel to the beam than in a direction at right angles. He used a beam of this sort as the primary radiation, and studied, by means of an electroscope, the intensity of secondary radiation proceeding from a sheet of paper in a direction perpendicular to that of propagation of a primary beam. By turning the bulb around the axis of the primary beam studied, the intensity of this beam was not altered, but the intensity of the secondary beam was found to reach a maximum when the direction of the kathode stream was perpendicular to that of propagation of the secondary beam, and a minimum when

these two were in parallel. Several methods were tried, all of them giving similar results. The variation of intensity of the secondary beam amounted to about 15 per cent of its value, but this does not represent the true difference, as beams of considerable cross-section were studied. Consequently, secondary rays making a considerable angle with the normal to the direction of propagation of the primary rays were admitted into the electroscope.—*Electrical Review*.

### Properties of Fluorescing Substances.

—If strongly fluorescing substances, such as akredin, eosin and quinine, are allowed to act upon lower organisms in the presence of light, they will manifest strong bactericidal properties. Similarly the action of ferments is inhibited and toxins, such as ricin, will lose their power to agglutinate red blood corpuscles. These phenomena are not observed in the dark or if the rays causing fluorescence are cut off. In order to determine any possible therapeutical value, H. v. Tappeiner and D. Jesionek (*Münch. med. Woch.*, November 24, 1903) applied eosin to three cases of epithelioma of the face and then exposed the ulcerations to the sunlight. In two, cicatrization was complete in fifty to sixty days, and in the third, an extremely malignant growth, which had destroyed almost the entire nose, healthy granulations were beginning to form. Equally good results were obtained in lupus, scrofuloderma and syphilitic affections of skin and mucous membranes, such as broad condylomata. The action is most intense where the diseased tissue lies exposed, but sometimes the action of light will set up an erythema which hastens ulceration and thus allows the eosin to act directly. Experiments on subcutaneous and oral use of eosin are in progress.—*Medical News*.

### The N-Rays and Radio-Activity.

It would be hard to mention an important scientific discovery which has attracted less public attention than Blondlot's beautiful researches on the rays which he has thus named. The daily press, which is usually generous to striking discoveries, seems hardly to have learned that N-rays exist. And yet no work within a decade gives richer promise of important results. M. Blondlot's latest discovery is that radiants which give out N-rays can communicate a similar variety of radioactivity to some neutral bodies upon which the N-rays fall. The phenomenon was discovered while concentrating the rays by a quartz lens upon a phosphorescent screen, when it was found that the N-radiation persisted with the lens as a source after the original source was removed. Following up this clue, it turned out that various other substances became temporarily active after exposure to N-radiation. A sheet of lead, for example, became active on both faces after exposure to the rays, producing an effect that might easily have been mistaken for penetration of the lead by a less experienced observer. In short, a set of phenomena closely similar to so-called induced radioactivity are produced by these extraordinary N-rays, which have so commonplace an origin as a Welsbach burner, and are reflected and refracted like any other kind of radiant energy. The N-rays appear to form a connecting link between the ordinary phenomena of light and the singular effects of radioactivity which have set the scientific world agog within the last year or two. No explanation of the latter can now be regarded as complete unless it takes full account of the former and their relation to ordinary radiation. A linkage of this sort is invaluable in preparing for generalization the great mass of experimental data that

has been accumulated. The complete emission spectrum of a radiating substance has thus far never been determined, and until this can be done the phenomena which belong to the radiation can not fully be determined. The study of the N-rays has opened a new field of investigation which seems likely to yield some very important theoretical results.—*Electrical World and Eng.*

### More Properties of N-Rays.

It has been found by M. R. Blondlot that there are several kinds of N-rays. Those first discovered increased the luminosity of a feebly luminous surface. He has now found a type which has the opposite effect. The new rays he has designated as N'-rays. He has measured the index of refraction and the wave-length of part of the spectrum of these rays. M. Blondlot has also found that a probable explanation of the failure of other physicists to repeat his observations lies in the fact that the emission of light is effected by the N-rays, in the sense of being concentrated upon a normal, rather than upon a tangent plane. Thus, if an observer is watching the surface perpendicularly, it brightens up, while if he looks along it, it appears to become duller. This condition is just reversed by the N-rays. The effect of the magnetic field, as observed by Gutton, appears to be the same.

As the wave-length of N-rays is extremely small, it might be expected that the rotation of polarized light produced by a magnetic field would be very pronounced. This has been investigated by M. H. Bagard, who used a prism of aluminum to separate the various beams of N-rays and polarized them by means of a glass plate held at a suitable angle. The source of the rays was a Nernst lamp. The polarized rays were trans-

mitted either thru aluminum or thru carbon bisulphide placed in a magnetic field. Even with a weak field, the rotation observed is very large, amounting to a maximum of 45 degrees in the case of aluminum, and 54 degrees in the case of carbon bisulphide. Repeating the same experiments with ordinary light, rotations of only four minutes were obtained.—*Electrical Rev.*

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#### Rod Auscultation.

In the *Post Graduate* for February Dr. J. H. Tyndale describes a percussion rod invented by Dr. Ed. Re'chmann, of Berlin. This little ivory rod is seven centimeters in length and is roughened so as to intensify the friction sounds when the fingers are passed over its surface. When the limits of an internal organ such as the heart is to be defined the stethoscope is applied to the organ, and near it the end of the rod is pressed down firmly upon the skin. The end of the finger is then rubbed downward upon the rod with moderate force. As the rod is moved across the borders of an organ the friction sounds are dulled. Using this rod a sharp outline of the individual lobes of the lung may be obtained without difficulty.

Differences in the density of organs and tissues can not be determined by this method.

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#### Sterilization of Water by Ozone.

Dr. Barbier (*L'Electricien*, December 12, 1904) advises the use of ozone, which is obtained by means of electrical discharges between plates of glass one or two millimeters apart. The air is first dried, then passed up thru a tower, in which it meets the water sprayed down from above. One cubic meter of air sterilizes six cubic meters of water.

#### Testing Oysters for Pearls.

A new use for the Roentgen rays is announced from Paris. M. Dubois has just read a paper before the Academy of Sciences, which shows that it is possible, by means of the Roentgen rays, to examine the living oyster, without in any way injuring it, and to ascertain whether or not it contains a pearl. If it contains only a tiny pearl the oyster is returned, and is allowed to live until the disease has sufficiently advanced.—*Electrical World and Engineering.*

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#### Orthopedics and Radiography.

An accurate diagnosis in a large percentage of orthopedic cases without x-rays is impossible, says Byron C. Leavitt, of Denver, in the *Denver Medical Times*, October, 1903. The condition of the bones is all important. In the region of the hip radiography is especially valuable, and without an exact diagnosis the treatment is often mere guess work.

He illustrates these statements with a brief history of a number of cases in which the patient received no advantage from treatment until an accurate diagnosis had been made by the x-rays, after which proper treatment being instituted prompt recovery followed.

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#### Radium in Blindness.

Dr. S. G. Tracy, in the *Medical Brief* for January, quotes Dr. Lunder, of Berlin, who found a distinct improvement of vision of two boys almost totally blind. He also reports some experience upon a case of optic atrophy of four years' standing. The radium tube was held half an inch from the eye for three minutes. Luminosity appeared and remained for half an hour. The treatment was repeated three times a week, and during the four weeks he has been under treatment improvement has been very marked.



# EDITORIAL

At the regular meeting of the Physicians' Club, of Chicago, held February 16, 1904, and reported in the *Illinois Medical Journal* for April, Mr. Clarence Darrow is quoted as follows (page 855) during the discussion on "graft":

"Another illustration came to me personally last week, and I had these two things in my mind when I spoke of physicians posing for public offices, which I do not believe in any more than the last gentleman who spoke. A man by the name of Fuchs, who takes x-ray pictures or skiagraphs, who is among the best x-ray men in the city of Chicago, and who is patronized by a large number of the best surgeons in the city of Chicago, brought to my office the other day a letter which was addressed to him by one of the officials of the State Board, saying he was going to be prosecuted for taking these pictures or skiagraphs because the law did not allow anybody but a licensed physician to take these skiagraphs. A number of surgeons in Chicago had spoken to me about this, because they are very much interested, and have asked me to do what I could in the man's defense. Of course I told them I would. But it appeared to me then, as it appears to me now, that this is purely a case where political doctors, not the best doctors in Chicago, who are put in office and are making money out of the office attacking this man as they attack dozens of others in your profession, for the graft that there is in it. These were the only two matters I had in mind."

There is no doubt that the use of x-rays for therapeutic purposes is medical practice. There is no doubt also that it is im-

possible to use the x-rays for diagnosis without also producing other effects. Before the therapeutic effects of the Roentgen rays were thoroly understood some photographers found this a paying branch of their business. Since it has become clear that such work by unlicensed practitioners is a violation of the medical law of this State, it is the duty of all good citizens to see that the laws are properly enforced. If it happens that there is one man whose experience and training are such that he can, with safety to the public, practice this or any other department of medicine, let such a man pass the required examination for a license; and if he refuses or is unable to do so let him have the same privileges as other violators, namely, either to cease his unlawful practice or to receive the penalty due. It is a subversion of justice to let one man escape for violations of law for which other men are punished. It is a disgrace for any man in a public position to advocate or condone such procedures.

The State Board of Health of Illinois has taken the stand that the medical law must be enforced impartially. They have courteously extended to known violators of the law a notice to cease violations, in order that they may not meet with punishment. In case such a notice is disregarded every physician and surgeon should loyally stand by the Board in its efforts to enforce the law. If the law itself is wrong let it be amended or repealed, but while it stands let there be no respect of persons.

We are credibly informed that some "ethical" men, in good standing in the Chicago Medical Society, have so far for-

gotten what is due to themselves, the Society and the profession, as to urge upon the State Board of Health immunity from prosecution for certain favored law-breakers.

When members of our own profession attempt thus to throw open the door to quackery, electrotherapeutists are justly incensed. Surgeons would properly resent an attempt to allow amputations to be performed by one whose only claim for recognition was manual skill in the work. Electrical workers in the profession resent equally an attempt to allow x-ray practice to be carried on by men who are not physicians, but who have skill in the mechanical art of photography. X-ray diagnosis is a part of medical practice, and its use by unlicensed men must be stopped.

The Tri-State Medical Society of Iowa, Illinois and Missouri will meet in St. Louis, June 15th, 16th and 17th. An interesting program is being prepared, and some of the most distinguished physicians and surgeons of the country will attend the meeting. The president is Dr. W. B. La Force, Ottumwa, Iowa, and Dr. Louis E. Schmidt, 1003 Schiller building, Chicago, is the secretary. Dr. James Moores Ball, 3509 Franklin avenue, St. Louis, is chairman of the committee on arrangements.

W. B. LA FORCE, President.

#### Operations Under X-Ray.

DEAR DOCTOR—Recently I had two cases in which the x-ray did signal service. It might be of interest to the readers of your journal to have them reported therein.

The first was that of a little girl four years old, who swallowed a 25-cent piece twenty-four hours before being brought to my office. The x-ray was applied and the coin was clearly discernible lying in the esophagus in front of the first dorsal

vertebra. Chloroform was given and a long curved forceps introduced into the throat. The forceps would not reach within a half inch of the coin although pressed in with considerable force. The anesthetic was diminished when the pressure of the forceps caused the child to gag, bringing the coin up within reach, when it was easily grasped and removed.

The second case was that of a boy twelve years old, who was shot in the back of the neck with a 22-caliber rifle. The ball entered the neck two inches behind and one inch below the lobe of the right ear, passing under the skull and lodging in the upper part of the mouth at the junction of hard palate and alveolar process. The bullet was located by the aid of x-rays and removed thru the mouth. No damage was done beyond a slight fracture of the hard palate and the boy is making good recovery.

Yours fraternally,

ROBERT TELFORD, M. D.,

Vancouver, B. C.

#### American Association for the Advancement of Science.

The annual meetings of the American Association for the Advancement of Science and of the American Physical Society will be held in St. Louis, Mo., in "Convocation Week," from December 28, 1903, to January 2, 1904.

#### Finsen Light and Roentgen Ray for Uterine Carcinoma.

Dr. George G. Hopkins, *Brooklyn Medical Journal*, December, 1903, considers that by these two methods combined carcinoma of the uterus and adnexa can be completely cured if taken before the disease has extended beyond this region.

He discusses the therapeutic value of various chemicals and describes his apparatus for the local use of Finsen light and x-rays.

## International Electrical Congress.

The following papers are promised for Section A—the section on “Theory”—of the Congress, of which Prof. E. L. Nichols is chairman and Prof. H. T. Barnes secretary:

### FOREIGN.

Prof. Dr. Paul Drude, “Metallic Conduction”; Prof. Dr. W. Jaeger, “Electrical Standards”; Sir Oliver Lodge, F. R. S., “Ions”; Prof. H. Nagaoka, “Magneto-Striction”; Prof. Dr. J. J. Thomson, F. R. S., subject to be announced; Prof. J. S. Townsend, F. R. S., “The Theory of Ionization by Collision”; Mons. J. Violle, “Secondary Standards of Light”; Mr. C. T. R. Wilson, F. R. S., “Condensation Neuclei”; Prof. P. Zeemann, “Magneto-Optics.”

### AMERICAN.

Prof. H. T. Barnes, “The Mechanical Equivalent of Heat as Measured by Electrical Means”; Dr. Carl Barus, “Atmospheric Neuclei”; Dr. Louis A. Bauer, “The State of Our Knowledge Regarding the Earth’s Magnetism”; Prof. D. B. Brace, “Magneto-Optics”; Prof. H. S. Carhart and G. W. Patterson Jr., Ph. D., “The Absolute Value of the Electromotive Force of the Clark and Weston Cells”; Prof. C. D. Child, “The Electric Arc”; Dr. K. E. Guthe, “Coherer Action”; Prof. E. P. Lewis, “Electrical Discharges in Gases”; Prof. L. T. More, “Electro-Striction”; Prof. E. Fox Nichols, “The Unobtained Wave Lengths Between the Longest Thermal and the Shortest Electric Waves Yet Measured”; Prof. E. L. Nichols, “Standards of Light”; Harold Pender, Ph. D., “Magnetic Effect of Mov-

ing Charges”; Dr. M. I. Pupin, “Electrical Theory”; Dr. Edward B. Rosa, “Alternating-Current Measurements”; Prof. E. Rutherford, “Radioactive Change”; Prof. J. C. McLellan, “Radioactivity of the Atmosphere”; Prof. J. Trowbridge, “Electrical Discharge in Gases”; Prof. A. G. Webster, “Electrical Theory.”

A meeting of the Congress Committee on Organization is scheduled for April 23 at 1:30 p. m., in New York. All Congress officers have been invited to attend. The meeting will be at 95 Liberty street, New York, at the offices of the American Institute of Electrical Engineers.

Acceptances of membership in the Congress number over 1,300, up to the present time, and 150 papers have been promised in all. The following societies have all promised to hold conventions at St. Louis during the Congress week, and to hold conventions with one or more sections of the Congress:

The American Institute of Electrical Engineers, American Physical Society, American Electro-Chemical Society, American Electro-Therapeutic Association, International Association of Municipal Electricians. The British Institution of Electrical Engineers has also arranged to coöperate under some plan, the details of which have not yet been determined.

The following bodies have promised to coöperate by sending delegates: The Société Internationale des Electriciens, National Electric Light Association, Association of Edison Illuminating Companies. Coöperation is expected from various other societies.—*El. World and Eng.*





### A Ukase Against the Wireless.

Last week we gave some very interesting details about the enterprise of the London *Times* in equipping a small steamship and land station at Wei-Hai-Wei with the De Forest wireless telegraph system, by means of which that dashing correspondent, Colonel James, has been sending brilliant and unique dispatches from around Port Arthur to that journal and the New York *Times*. Immediately following upon that article came the news that at Washington, on April 15, the cabinet discussed a communication received by the state department from Count Cassini, the Russian ambassador, which apparently means that the Russians intend, if they capture any press correspondent using wireless telegraphy either near land or on the high sea, to treat him as a spy and hang him. It is understood that similar communications were made to the foreign office of other nations. The note received by Secretary Hay is as follows:

"I am charged by my government, in order to avoid all possible misunderstanding, to communicate to your excellency that the lieutenant of his imperial majesty in the far East has just made the following declaration:

"In a case in which neutral steamers having on board correspondents who might communicate war news to the enemy by means of perfected apparatus not being yet foreseen by existing conventions would be arrested near the coast of Kwan-Tung or in the zone of operations of the Russian fleet the correspondents will be looked upon as spies and the steamers furnished with wireless telegraphy seized as prizes of war."

This action has created a sensation and is now under vigorous discussion on both sides of the Atlantic. According to advices from London, the communication from the Russian government to the Brit-

ish foreign office intimates that Russia does not contemplate any immediate action in the matter.—*El. World and Eng.*

### Suggestion.

Let us turn to some of the legitimate uses of suggestion in therapeutics. The first of these is in self-confidence begotten of thoro knowledge on the part of the physician. There is no royal road to learning. Proficiency in therapeutics is paid for by long years of hard study and close observation. The physician's ability to make an accurate diagnosis is the first requisite for securing both his own and the patient's confidence in his ability, correct prognosis the second, and when there is added to these a thoro knowledge of the physiologic action of his therapeutic agents, then the physician can prescribe his remedies with confidence, adding to their physiologic effects the expectancy of the patient's mind. No one is justified in prescribing a placebo; that is a confession of ignorance. The physician should know what to expect from his remedies, and this expectation he should place before the patient with all the positiveness he can command, not hedged even by the doubts that may be in his own mind.

But it is not necessary nor desirable to deliver a lecture on pathology with each prescription as is the custom of some. The patient, especially if he is neurotic, is already too much engrossed with his symptoms, and it should be an object to turn his attention away from himself. Rather shame him for sitting like the navel gazers studying his internal sensations. Is he a hypochondriac as most of these patients are, tell him of such instances as Beethoven whose very soul was music, yet long after he could not hear a note of the loudest instrument he went on composing

music for others to enjoy; of Henry Fawcett who, after he became blind, went through Cambridge University and became a professor, then into public life, and was England's most capable Postmaster General; of Laura Bridgman, both blind and deaf, yet who found life a joy and blessing; of William of Orange whom Macaulay calls an asthmatic skeleton, or Luxembourg, his opponent at the battle of Landen, who was a hunchback dwarf. Preach to him the gospel of work with Thomas Carlyle, who exclaims: "Produce! Produce! Were it but the infinitesimal fraction of a product, produce it in God's name. 'Tis the utmost thou hast in thee, out with it then. Up! Up! Whatsoever thine hand findeth to do, do it with thy whole might!"

The doctor must himself set the example. He must be courageous, enthusiastic, hopeful and masterful. An ill doctor cures no patients. The pessimistic doctor can not in good faith bid his patient go forth into God's sunshine and green earth and be healed.

But after all "The dog returns to his vomit and the sow to her wallowing in the mire," so these patients *enjoy* poor health. The nearest some of them ever come to being happy is when, like the Ancient Mariner, with the glittering eye, they find a sympathetic listener to their tale of woe; indeed, sympathy and condolence come to be their meat and drink. Like the derelicts of the ocean they would not be worth the dynamite needed to blow them out of the water were it not for the menace they are to the other craft.

And yet what may be accomplished in some of these cases when suggestion is made through the right channel is shown by a case that came under my observation. A fellow-boarder, a woman, was a typical valetudinarian. She had corneal opacities,

and iridectomies had been made to secure colobomata opposite the best parts of the cornea, but even with lenses of complicated formulas she could not see to read or to do fancy work; her only occupation was introspection. Each meal-time brought some new complaint or a variation of the old ones. She became a convert to Christian Science and as at the wave of Ariel's wand her character changed. She ceased to speak of her infirmities, laid aside her spectacles, and whether her opacities cleared up or not I can not say, but such a result has been known to follow. She left the boarding-house and became a model housekeeper. The right channel in this case, as in many others like it, was the religious susceptibility, a broad one that has as yet been but little exploited. But that is work for the theologians to do. Perhaps some day they will begin to preach the duty of happiness in this world as in the next one.—*Dr. Grube, in Cleveland Med. Jour.*

#### Hydrotherapy, Electricity and Massage in Diseases of Children.

Dr. Herman B. Sheffield, in the *Post Graduate* for February, says it is a good rule never to give children a drug when any other remedial agent may be employed. In using water for children, extremes of heat and cold should be avoided. He describes the various modes of its application, both externally and internally, commending especially high enemas of saline solutions for uremia, typhoid fever, scarlet fever, smallpox, measles, diphtheria, eclampsia, anemia, hemorrhage and shock. We emphasize his recommendations.

A nine-tenths of one per cent salt solution at a temperature of 100° F. is injected slowly thru a colon tube for fifteen or twenty minutes.

In discussing electricity, Dr. Sheffield has apparently fallen behind the age, as he knows only "galvanic, faradic and static." His rules for the application of electricity indicate also his unfamiliarity with the fundamental principles of electro-therapeutics.

#### Cancer of the Cervix.

Dr. W. B. Chase, *Brooklyn Medical Journal*, December, 1903, recommends the thermo-cautery for this condition as a palliative measure which is sometimes followed by cure. Salutory effects also follow the use of the Roentgen rays, which cause rapid disintegration of malignant structures with healthy resultant granulations.

#### Hydropathic Treatment of Acute Sepsis.

J. Wernitz (*Samml. Klin. Vortr.*, N. F., No. 352) advises the injection into the rectum of large quantities of a warm one per cent salt solution until the contents are thoroly cleaned out. A high rectal tube is used. The colon is kept full of the salt solution under low pressure for an hour afterward. The results are increased secretion of urine, decrease of thirst, free perspiration and reduction of temperature.

#### X-Ray for Epithelioma.

Dr. D. W. Montgomery, in a paper read before the San Francisco County Medical Society, described his work with x-rays. Exposures were made thru holes in lead sheets, which were supported on a wooden frame. After six to fifteen exposures, given for ten minutes on alternate days, a visible reaction was obtained. The tube was brot sometimes as close as one and a half inches in order to get a strong reaction. Then a vacation was given, and, if necessary, a second series of exposures followed. He advises the x-ray for nearly all skin cancers.

#### Results in Roentgen Diagnosis.

The advance made in diagnosis has raised the standard by which the surgeon's methods of diagnosis and treatment should be judged. The patient who is suffering from a fracture should not be compelled to submit to pain and further injury from diagnostic procedures. He can not demand results out of proportion to the injury he has sustained, but he can demand as "reasonable care" that the Roentgen method be employed.

The value of these examinations is not wholly the patient's. They guard the interests of the practitioner. They show how serious the osseous injury has been, that a reasonable apposition has been made and that the fixation apparatus is effective. This is valuable evidence. The established value of this method makes it necessary to employ it in every case, but especially in any case where a reasonable doubt exists. If it has not been employed, or its use suggested and aid refused by the patient, it can not be said that all reasonable care and means have been used to the best of the surgeon's knowledge and ability.

The increased efficiency of treatment resulting from this more accurate and early method of diagnosis has a widespread effect. This effect has been particularly noticeable in the diagnosis of calculous conditions of the kidneys and ureters. In these conditions the symptoms are often vague and misleading, often out of all proportion to the seriousness of the case. A small quiescent calculus may form the gravest menacc. Its impaction may result in complete anuria and the destruction of the kidney. The symptomatology does not differ from less serious conditions. The symptoms may all subside and yet an anuria be present. An undetected calculus is always dangerous. The presence or absence of calculi should be determined



after a suspicious attack of renal or ureteral colic. This knowledge gives the exact position of the calculus if present, and forms in conjunction with other symptoms, an accurate basis for treatment. If the calculus is too large to be passed it can be removed at once, and the kidney saved from further injury. If its size shows that it can pass, and there are no threatening symptoms, a course of conservative expectant treatment can be followed. Such a course is only reasonable when based upon such exact knowledge.

The accuracy of this method of diagnosis has been shown in a series of three hundred and five cases that have been referred for examination. Calculi have been found in eighty-nine cases, while sixty per cent of these calculi have been found in the ureter. The negative diagnosis has proved more accurate than the positive. Errors have been made in nine cases or less than 3 per cent. In only one of the forty-five cases of negative diagnosis that were subsequently operated on was a calculus found. In two others small calculi were afterward passed. This method has been shown to possess the following advantages:

It is free from all the dangers that ac-

company exploratory operations and catheterizations. It is most accurate and comprehensive without occasioning pain, injury or even inconvenience to the patient. The exact number and situation of all calculi are determined so accurately that no calculi are left behind and the operation is certain to be complete. The danger of operating upon the wrong kidney is entirely avoided, and the field of operation is limited to the exact position of the calculus, thus decreasing the operative trauma and facilitating rapid recovery.

The accuracy that has been demonstrated in the negative diagnosis makes it unnecessary and unreasonable to open the kidney in the search for stone during nephrorrhaphies or exploratory operations. The diagnosis can be made early when the least suspicion points to the presence of a calculus. The dangers from small quiescent calculi are thus avoided and the basis formed for reasonable treatment. This method is not infallible, as much depends on the accuracy of its employment and interpretation. All other methods should be employed in connection with it, but no diagnosis can, however, be considered complete without it.—*Charles Lester Leonard in Brooklyn Med. Jour. for Jan.*

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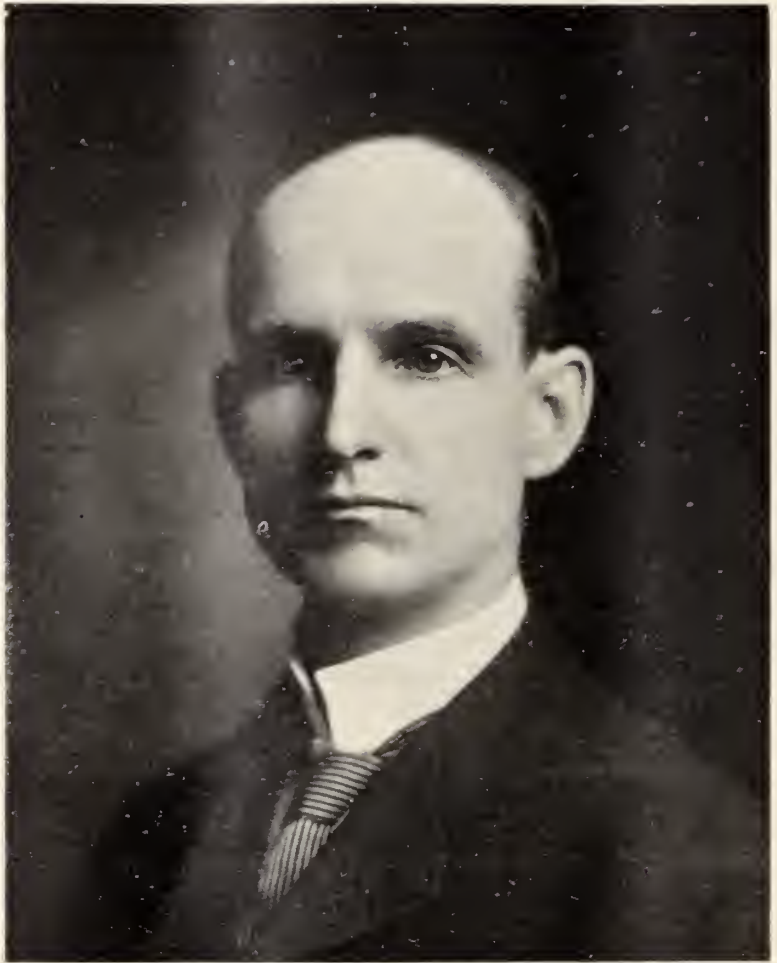
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DR. STUART JOHNSTONE  
President Chicago Electro-Medical Society



# THE AMERICAN X-RAY JOURNAL

Devoted to Practical X-Ray Work and Allied Arts and Sciences.

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## What is Electricity?

BY T. PROCTOR HALL, PH. D., M. D.,

CHICAGO.

If I were to ask, "What is Four-fold Space?" or, "What is Dimethylamidoazobenzene?" or even "What is Harmony?" perhaps not very many of those present would be able to give a complete and satisfactory answer. Nor would it be possible for the best of teachers in a few minutes to give such an answer to any one of these questions as to make the subject clear to a five-year-old child. Before he can know anything of four-fold space he must be familiar with the principles of elementary geometry. Dimethylamidoazobenzene is to him worse than Greek until he has some knowledge of organic chemistry. Harmony is incomprehensible without some knowledge of music.

Any difficulty that may exist in answering the question "What is electricity?" is found either in the want of skill of the teacher or in some defect in the preliminary knowledge or in the want of capacity of the learner, and not in the subject itself. There is a popular idea that the nature of electricity is unknown, but this idea is entirely wrong. It is true that we do not know all about electricity. Neither do we know all about air or water; and we do not expect to ever know all about either of them. I am safe in saying that we know the nature of electricity quite as well as we know the nature of air or water, and in some respects better.

As a preliminary step let me call your attention to this list of all the things that are known to exist:

1. Matter.
2. Space.
3. Time.
4. Energy.
5. Spirit.

In the first class (matter) are included all the things that have weight or occupy space, from the largest of the suns to the tiniest fragment of an atom, and from the largest imaginable metal to the all-pervading intangible luminiferous ether. Matter can be transformed; it may take a multitude of different shapes; but it can not be created and can not be destroyed by human agency. So far as our powers go, it is eternal.

Is electricity a form of matter? It is not. Why? Because it has no weight and does not occupy space. It can not be changed into other forms of matter, nor can they be transformed into it. In spite of the fanciful speculations of some very prominent physicists, both in Europe and America, this answer is final and conclusive. Electricity is inseparably associated with matter, but it is not matter.

The second and third classes (space and time) are each so entirely different from everything else that it is unnecessary to do more than point out that they are both, so far as human powers go, uncreatable.

indestructible and eternal. Not even a crank has made the suggestion that electricity belongs to either of these two classes.

Energy is capacity for doing work. It is not force, and it is not motion. It is simply and solely the ability to do work. A bent bow has energy that the same bow unbent does not have. This is only another way of saying that a bent bow can do work that an unbent bow can not do. A rock on the top of a hill is capable of doing work (as it rolls down) which the same rock at the foot of the hill could not do. In other words, the rock at the top of the hill has energy on account of its position. A ball shot out of a cannon is able to do work which the same ball at rest could not do. The moving ball has energy of motion. These illustrations will make it clear that energy is something that a given portion of matter may gain or lose. But if energy is gained it is gained from some other portion of matter, for no energy is ever created. Nor is energy ever destroyed. Like matter, space and time, it is uncreatable and indestructible by human power.

Electricity is a form of energy. This statement might be objected to by some mathematicians who use the word "electricity" in a very restricted technical sense; but in the popular meaning of the word this statement is correct. Electricity is known to be a form of energy by these two facts: as often as a given amount of electricity is produced a certain amount of energy in some other form disappears, and when that electricity disappears an equal amount of energy appears in some other form.

Electricity is not spirit. Spirit is known by its capacity for receiving sensations and of becoming conscious. In the sense in which I use the word, which

is entirely apart from any theological doctrines, everyone who hears me is a spirit. Consciousness itself is not a permanent and indestructible thing. Like motion, it may appear and disappear, but the something which underlies consciousness, whatever that may be, the something which is sometimes conscious, and which retains its individuality thru successive periods of unconsciousness, this is what I mean by spirit. If spirit is different in its nature from everything else in the universe and if each of the other classes of things is by itself eternal, analogy would lead us to infer the same uncreatability and indestructibility of spirit also. In all the universe we find transformation, but not annihilation. If spirit is of its own kind, and all the other kinds are permanent in quantity, this, too, must be permanent in its totality.

Having found the class to which electricity belongs, and having, in consequence, some general notion of its nature, let us look into it a little more closely.

In physics, which is the science of energy, we have the following branches:

Mechanics, treating of the energy of masses.

Heat, the energy of oscillations and collisions among atoms.

Sound, the energy of waves of compression.

Radiation, ether waves and streams of electrons.

Electric currents, vortexes of atoms and ether.

Electric charges, ether strains.

Magnetism, ether strains (of another sort).

Gravitation, chemical energy, and a few other forms, whose exact character is not so well understood.

Regarding the general nature of electricity all electricians are practically

agreed, but when we come down to particulars there is considerable difference of opinion. In what follows, therefore, I do not claim to speak for any one but myself.

An electromotive force is any force that tends to produce an electric current. Wherever such a force exists the atoms in the vicinity are polarized and tend to be arranged in chains, like little bar magnets adhering end to end. Whether the atoms actually take on such a chain-like arrangement or not depends upon their conditions. The atoms may be combined with one another so firmly that such an arrangement is impossible without tearing them apart from each other. In this case the substance is called a nonconductor, and no electric current is possible. In another case, as in a piece of copper, the atoms are so freely moveable that they promptly assume the chain arrangement, and then if the chains form complete circuits all the atoms in the chain rotate, and this rotation is what we call an electric current. The polarizing and rotating force (electromotive force) may be applied at any part of a conducting circuit, and power may be conveyed along the atomic chains in either direction, in the same way it is conveyed by a shaft in a machine shop. So far as the mere transmission of power is concerned the direction of rotation of the atoms in the chains is indifferent.

There are in such chains only two possible directions of rotation, right handed or positive, and left handed or negative. If you stand beside a wire running north and south, in which there is an electric current flowing north, then looking to the north you have the atomic rotations right handed or positive. Turning toward the south you have the same rotations now left handed or negative. Every

electric current is at the same time both positive and negative, according to the point of view. A positive current going north is precisely the same thing as a negative current going south. In neither is there anything flowing along, either in or about the wire, unless it be energy, which may be conveyed in either direction or in both, by the rotations.

Having clearly in mind this concept of an electric current, it is easy to apply the common laws of mechanics and deduce the laws of electricity. These rotating chains of atoms behave in every instance just as they should be expected to behave. There is no more mystery about them than there is about the shafts, pulleys, belts and gears in a machine shop.

The amount of current in a wire is measured by the total amount of rotation per second in it. Ten atomic chains, each making a million turns per second, give the same amount of current (current intensity) as a million chains, each making ten turns per second. The practical unit of current is called the ampere, and is represented approximately by one million chains whose rotation is such that the surface of each atom moves with the velocity of light, a speed such that the atom would roll round the world seven times in a second.

These atomic rotations do not escape some resistance. The atoms of all bodies are in constant irregular motion, striking against each other. The energy of this motion is known as heat. When the rotating atoms collide with the rest or with each other they increase the velocity of this heat-motion. In other words, they raise the temperature of the conductor. Each time such a collision occurs there is a loss of some of the energy of the rotating chain that would otherwise be spent in increasing the rotary speed of the



chain. In silver, copper and other good conductors there is relatively little of the energy of a current lost in this way. The resistance of these metals is small, and, what is still more interesting, the resistance gets smaller as the metal is cooled. Cooling means decreasing the vibratory speed of the atoms. By and by a point would be reached (if the cooling were to continue) when the heat-motion would all have disappeared. This point is known as the absolute zero of temperature. Now if we mark down on paper ruled in little squares the resistance of silver at various temperatures, as low as possible, and then draw a curve thru these points, and do the same thing for several other metals, we find that all the curves meet at a point corresponding to the temperature  $-273^{\circ}$  C. and to resistance zero, indicating that at that temperature all irregular motions of the atoms and all resistance to electric currents would cease. When I tell you that the boiling point of liquid hydrogen is about  $-235^{\circ}$  C. you will see that physicists have actually reached a temperature that is within easy walking distance of the absolute zero.

In order to get a mental picture of the nature of an electric charge we may suppose that at some part of an electric circuit the conductor is replaced by a non-conductor such as air or glass. At the surface of the glass the atoms are turned a little by the electromotive force, but their elastic reaction then becomes as great as the electromotive force, and there is no further motion, the atoms remaining in the strained condition. In glass a little of the turn of the atoms at the surface is carried to the next atoms, and so on. In mica two or three times as much of the turn is passed on to the next atoms, and electricians therefore say that the dielectric power of mica is two or three

times as great as that of glass. The dielectric power of silver is nearly infinite, that is to say, the turn is conveyed from one atom of silver to another with perfect freedom.

This condition of strain at a surface is called an electric charge. Its characteristic is that it has an unfailing tendency to turn back to its former condition, and in so doing it makes a current. The charge produced by a positive current, the charge on that surface of the glass in which the rotation is right handed, is positive, and in untwisting produces a positive current from that place. The charge on the other side of the glass is negative or left handed, and produces a negative current. Both turns are in the same absolute direction, however, and if the glass is thin and the electromotive force is strong enough the force on each side helps the other to break the atoms from their attachments and forces them to rotate with violence. This pierces the glass, causes heat and strong ether waves (light). The whole action in that case is called an electric spark.

With this view of an electric charge it is easy for a mathematician to deduce from the known laws of energy the laws of attraction and repulsion of electric charges, laws which are made the foundation of the older electrical theories.

The luminiferous ether may be thought of as a soft elastic solid. When a chain of atoms in this ether rotates, the ether that is in contact with the atoms is dragged round a little way, and the strain extends outward in less and less degree from the chain. When the rotation ceases the ether drops back to its former place, and the strain disappears. This shearing strain about an electric current is magnetism. Magnetism, then, must always exist wherever there is an electric current; and it

may continue to exist after the current that excites it has ceased.

When the lines of atoms rotate first in one direction, positively, then negatively, the current is said to be alternating. From the sides of an alternating current proceed magnetic waves which resemble waves seen on the surface of water. Since these waves are not symmetrical in all directions about their line of advance from the current, they are called polarized waves. From the end of a row of conducting atoms proceeds a set of cylindrical waves. These are symmetrical about their line of advance, and answer to all the marks of waves of common light. A little reflection upon these two kinds of waves will convince you that tho the magnetic waves seem to be magnetic

only, and the others electric only, both sets are really electro-magnetic in character. If the ether in the magnetic or plane-polarized waves moves in an elliptical or a circular circuit the waves become elliptically or circularly polarized. All these kinds of light are well known to the physicist. The explanation I have just given of the nature of light is known as the electro-magnetic theory of light.

If you have followed my explanations up to this point you will see that having a clear concept of the nature of electricity the electrotherapist is not working in the dark in the use of this valuable agent, but is able to predict even in advance of clinical results the therapeutic effects of electric treatment.

## Electro Therapeutics.\*

BY D. A. STEVENS, M. D., CHICAGO.

The application of electrical currents for their direct and indirect influence upon diseased processes has now reached a stage of development, accuracy and certainty which demands for it the attention of every progressive practitioner. The time has passed when we can tell our chronic patients that there is nothing in electricity. They will think we are ignorant of its benefits, or manner of application, or that we belong to that rapidly passing type who think a stethoscope, obstetrical forceps and prescription book are all that is needed to attain success.

The field of the physician is constantly broadening; the so-called incurable diseases are one by one being eliminated from the list. In no one line or adjunct has there been such results shown as in electro-therapy. I do not except the great

work accomplished along the line of bacterial research. I am constrained to ask what the showing would be had we the same effort, time and number of the best men in the profession working along this line?

I wonder if we realize what is being done? With the whole profession world-wide investigating bacteria, toxins and serums, what have we curative to offer for all this labor? *Diphtheria*. In all the other diseases there is nothing certain to offer.

Now a few men, scattered widely, with little support from the profession at large, have so perfected the apparatus and technic that today we are curing all malignant growths which have good drainage and do not involve bone tissue. This alone would discount any other recent advance in the healing art, but with the confidence of a warrior battling for a

\*Read before the Illinois State Eclectic Medical and Surgical Society, May 20, 1904.

righteous cause we have met eczema in all of its manifestations, and it is ours. Favus has proven easy. Lupus has been treated with success. Even the great white plague, tuberculosis, in its incipient and early stages, responds satisfactorily, while tubercular glands in all stages are permanently reduced. The results in gynecological work have opened up a new page for women who do not wish surgical intervention.

I can not hope to touch upon this subject with any great thoroughness or detail in the short time allotted for this paper. But I want to make a plea for closer study and more accurate technic. Then, and then alone, can we expect results.

Where a case presents itself to you and you say you will try electricity, some vital points must be known before proceeding. First, What is the pathological lesion, status and condition of the patient? Second, What current, what pole, what dosage, frequency of application, and how apply? This will bring you to the point where the need of a fundamental knowledge of the whole subject will be realized. No one would think of getting uniform results from drug medication, without being cognizant of physiological action, dosage, therapy, indications and contra-indications. We must study and use electricity just as specifically. The promiscuous use of the faradic and galvanic currents without adequate knowledge of their indications can not be too strongly condemned. Never was the admonition to readjust ourselves to the advanced ideas in using this element so timely or uttered at a more opportune moment.

Not knowing that there were other papers upon this subject to be presented, I prepared a paper covering the field, as my subject would indicate, but upon receiv-

ing a program this last week I notice men with various divisions of the subject. So I made a motion to table my paper, then upon reconsideration sent it to the waste basket. About the only thing left for me was high frequency, which I will talk upon to the exclusion of the more familiar currents, which I think will receive better treatment under the presentation of the able exponents assigned for these subjects. Some go so far as to claim that this current supersedes all others as to therapeutic value. Certain it is that upon the continent the investigation and attention has been given largely to this H. F. C., the possibilities of which seem to be only touched upon. I hope the doctors will take up the paper and discuss it thoroly, that we may gain some ideas from each one, as the field is, in a large measure, unexplored, and we want the milestones marked out for those who follow.

The high frequency current of today is generally understood to be a current derived from a coil or static, with a step-up, or transformation coil, interposed. The ordinary current as derived from the static is a true high frequency current, but the term as used today, both in Europe and this country, refers to that current used by d'Arsonval and Oudin, and Tesla, of the States.

It may be obtained in many ways and in varying frequencies. It is *primarily* derived from the static machine, induction coil, commercial alternating current and Tesla coil. Of these sources of primary energy the first two are the ones we will most likely find in use. The high frequency current delivered to the patient will be the same in effect, generated by either agency. As is well known, the voltage of a static current is about 50,000 for the first inch of spark gap, reaching into the millions at its full capacity.



That this enormous voltage can be passed thru the human organism without apparent harm or sensation goes to prove that voltage is harmless without amperage.

This step-up, or increase in frequency, is obtained by passing the current thru a coil of coarse wire, which, after being insulated, is rewound with a second coil of fine wire. The lines of force from the primary coil being broken so many times by this secondary that we get an induced current of fabulous frequency and tension, so high, indeed, that, like waves of light that are too short to be recorded by the sight apparatus, so a sensory nerve capable of transmitting sensation at the rate of 20,000 per second becomes utterly incapable of transmitting a vibration or stimuli of many millions' frequency. So we can see why these currents cause no pain upon application, and the wonderful way in which they sedate pain is, I think, explained by the fact that the rapid vibration causes a temporary cessation of the function of nerve thru over-excitation.

This current is applied by means of vacuum glass electrodes of various forms to suit the uses for which intended. When lighted up by the current passing thru the vacuum, there is a beautiful violet glow, and a stream of visible vibrations of light or energy flows toward the distal extremity and centers upon whatever part of the tube is in contact with the patient.

The patient is not insulated, and one pole is usually grounded. There seems to be a preference for the negative pole for treatment, having a greater quantity of chemical rays and not being so harsh as the positive. However, the difference is not great. The electrode is placed in contact with the surface to be treated, and we notice moisture under the electrode very quickly. In a few minutes there is

active hyperemia present and some tingling and sense of warmth. Over sensitive areas we get quite an influence; over muscular action enough to cause a jerking of the head when treating the cervical region; contraction of eyelids when treating temporal or supra-orbital region; of the fingers when near the ends. The spark from the glass tubes seems to have most of the sting taken away, yet that the penetration is much greater than with other sparks is shown by the fact that it is transmitted thru glass and hard rubber. The non-conductors do not confine this current. Like the static currents which give us the brush discharge thru wooden electrodes (classed as a poor conductor even when damp), owing to the high voltage, so in the much greater voltage and frequency of the high-frequency current we are enabled to pass thru one-half inch or more of hard rubber. This great penetration would seem to disprove the generally accepted views that the effect of the high-frequency current was only superficial and useful only in skin diseases.

I think in this modality we are dealing with two distinct forces during its application: First, the chemical action whereby the passage of energy from the tube thru the air to the tissues breaks up the air, forming a wealth of ozone, and a small percentage of nitrous acid. The current seems to carry the ozone into the tissues. for after several hours, and repeated washings, the odor is still prominent at the point of treatment.

The nitrous acid is present in just sufficient quantity to irritate cell life to that extent, to set up a healthy action. The ozone favors a rapid oxygenation, which seems to be fatal to all germ life. While we have not yet laid the crime of eczema at the door of the bacteria, yet the success of this treatment would cause me

to lean toward that theory of cause. Its destructive power over germ life is very clearly shown in pus formation, such as boils, abscess, ulcers and pathological lesions due to pus organisms. The action over germ life is no doubt also due to the presence of ultra violet rays of light, while we know that the ultra violet ray will not penetrate a very thin crystal of glass, yet the vacuum tubes under excitation from the high-frequency apparatus does produce violet rays. Clinical tests would prove this, and again the positive test of the fluorescence of willemite shows the ray present and active. This chemical and light action of the high-frequency current is—well, we might call it the active principle of the application to skin diseases and other superficial lesions.

But experiments in using the high-frequency current shows an action from the current proper. This current will light a 16-candlepower incandescent lamp to a full glow. At the same time this can be passed thru the body, in circuit with the light, without any sensation to speak of. Now it is a fact that one-fourth ampere or 250 ma. of a steady current is required to light this bulb. This much current from the galvanic battery would be rapidly destructive; from the street current with only 110 volts it would be in many cases fatal. What is it we have here that so nullifies the action? Does the great frequency cause the bulb to glow under a small amperage? Or is there some condition present which so modifies the action of this large current that it can be passed safely thru the body? If the large amperage is present, where is its source? These are some questions to be solved.

That the high-frequency current has a destructive action was shown by experiments carried on by Bordier and Le Compt, who, in a report to the Academy of Sciences of Paris, showed that when applied to small animals death ensued. Application was made by metallic bands around the abdomen and throat. Paralysis occurred, followed by death a few days later. Upon application with one electrode in the mouth and the other in the rectum, death occurred with a rabbit in fifteen seconds, a guinea pig in seven seconds and a rat in forty seconds. D'Arsonval observed results which coincided with these. So we will see the need of proceeding with caution, and the importance of not using this modality indiscriminately. Some of the manufacturers of electrical apparatus are illustrating ways of using this current and proclaiming for it a "panaceal" value, if you will pardon the term. I think when the monopolar application is made, as most of us use the current in this country more for its chemical and superficial effect, it is absolutely harmless in any dosage. But the bi-polar application needs to be observed very closely, and in working out a technic I would advise its use in the same class of patients and conditions recommended for the static currents. I think without doubt the rapid frequency will prove a better means of relieving pain than any other mode; also the sparks will penetrate further and are less painful than the static sparks. We have in this high-frequency current great promise, and the near future will bring it rapidly to the front. I bespeak for it your earnest investigation.



# General Remarks on X-Ray in the Treatment of Cancer and as a Diagnostic Agent.\*

BY ROBERT S. GREGG, M. D., CHICAGO, ILL.

Radiographer in Dr. Pratt's X-Ray Laboratory.

We see much today in the medical journals pertaining to the x-ray and its different fields of usefulness.

We note that it has become indispensable in the treatment of superficial lesions of the skin such as epithelioma or skin cancer, lupus, eczema, acne, etc. On the other hand we are forced to admit its very limited usefulness in deep-seated malignant conditions such as carcinoma of the stomach, liver, colon, etc. However, experience is the great teacher of the ages and I am quite sure we have had experience enough to teach us of the merits and demerits of the x-ray. The x-ray is not a panacea, as some would have you believe. Its greatest field of usefulness is probably in diagnosis. There are many disorders of the skin that are amenable to its influences and again there are superficial conditions wherein the x-ray is absolutely dangerous.

When we stop to consider the enforced metabolism which takes place under its influence, we are brought to a realization of the possibilities of danger as well as of cure, we are bound to respect the law of physiologic change or else suffer the consequences.

Judging from my own experience, carcinomata of long standing, with glandular involvement, do not heal under x-ray treatment. We have been able to minimize the pain, to some extent lessen the discharge and probably retard the growth of the tumor. But, on the other hand, we have no doubt hastened death by prolonged raying, especially of an ulcerated area where rapid destruction of tissue has

taken place beyond the power of the body to dispose of. We then observe a rapid metastasis, a consequent sepsis, and death.

I do not consider it advisable to treat with the x-ray carcinoma of long standing, such as we at times find in the mammary glands, where connective tissue contraction has taken place, because we are liable to stimulate the epithelium to renewed proliferation, and if left alone at this stage the patient will probably not die of cancer.

The x-ray has cured and does cure superficial lesions such as epithelioma of the skin or skin cancer, lupus, eczema, acne, and many others. Even psoriasis yields very beautifully, but whether it will return in every case as it seemingly does under other modes of treatment, in my experience remains to be seen. I am very sanguine in this regard. But for deep-seated conditions, such as carcinoma of liver, stomach, enteron, or colon we have no direct means of knowing just what is taking place. All we can do is to expose from day to day on the expectant plan. The treatment is a method of empiricism whereby we disseminate cancerous debris by a rapid destruction of tissue, and cause absorption of septic material with its dangerous consequences.

During my three years' experience with the x-ray in the treatment of superficial and deep-seated malignant conditions I have yet to know the first case of deep carcinoma which has been cured by x-ray. To be sure, patients have seemingly been benefited in uterine cancer inasmuch as pain has been reduced and discharge lessened, which has been a great source

\*Read before the Illinois State Eclectic Medical and Surgical Society, May 20, 1904, Chicago, Ill.



of relief to the patient, but beyond that I can not speak encouragingly.

I am inclined to believe that reported cures of deep-seated carcinoma by x-rays are cases of mistaken diagnosis.

I have watched very carefully superficial and deep malignancies under treatment and have known patients to succumb very rapidly from sepsis shortly after vigorous x-ray treatment was begun.

The conditions which, from my experience, I consider amenable and those which do not apparently yield to x-ray treatment will class as follows:

**Probable Cases.**—Epithelioma or skin cancer without metastasis, lupus, eczema, acne, etc.

**Possible Cases.**—Epithelioma or skin cancer with severe metastasis, carcinoma of mammary glands with metastasis, tuberculosis of joints and glands and psoriasis; Hodgkin's disease or sarcoma.

**Improbable Cases.**—Uterine malignancy, gastric malignancy, enteronic and colonic malignancy, hepatic malignancy.

Its diagnostic value is certainly its great redeeming quality. X-ray shadows are not false, it is merely a matter of interpretation, therefore experience is the paramount factor in making diagnosis from x-ray negatives as negatives are more reliable than reprints. It is really surprising how little one can actually see when examining an x-ray negative, no matter how well versed in anatomic structure, unless he has trained his eye and understands the character of the shadows different structures give.

For precise results much depends upon the apparatus, the amount of current, the x-ray tube, the position of the part to be photographed in its relation to the plate, the preparation of the patient where hepatic and ureteral calculi are in question,

length of time of exposure and character and vacuum of tube. In other words, only close application with appreciation of minor details and long experience will enable one to produce good results.

The fluoroscopic examinations are of the greatest importance in certain regions of the body, for diagnostic purposes, yet their value becomes practically nil in the regions where one would naturally expect to find renal, hepatic and vesical calculi. If the patient be very spare one may with some degree of exactness be able to arrive at an approximate estimate as to the cause. However, one must depend, for his absolute findings, upon the skiagraph. In cases of failure to find a shadow, repeated exposure should be employed.

Next in importance is the position of the part to be photographed. It is absolutely necessary that the part to be photographed should be in as close contact as possible to the plate. Otherwise it is useless to try and produce a good x-ray picture.

This rule applies particularly when you are looking for hepatic or ureteral calculi and it is not an easy matter to photograph these conditions.

In taking pictures for ureteral calculi it is necessary to elevate the shoulders and flex the thighs upon the abdomen. Sand bags are very efficient for the shoulders and a double inclined plane for the limbs. In this way you bring about a convexity of the dorsal surface which brings it in close contact with the plate.

In hepatic calculi the ventral surface to the plate is the position required. It brings the gall bladder in close contact with the plate. In this position the shadows are not diffused in being carried through the body, as would naturally be the case were they photographed in any other way.

The length of time for exposure depends upon the vacuum of the tube, the density of the part to be photographed and the power behind the tube. The higher the vacuum of the tube the greater the penetrating power and the quicker the decomposition of the silver salts on the plate through dense tissue and vice versa.

One must be governed by the corporeal dimensions of his patient and experience is the only teacher.

Developing is an art as well as a science, and the personal equation enters into this as into every other art. No single rule can be laid down that will meet with the precise requirements of every artist or operator. One must work out his own experience and apply his skill and knowledge to the best advantage from the facts at hand. We wish here merely to deal with the essentials as regard the needs from an x-ray standpoint. Distinct contrast and minute details are the two important features in a skiagraph, and for diagnosis of ureteral calculus *both of these are indispensable*. Plates should only be exposed in a dark room in the presence of a ruby light. A tray, preferably of vulcanized rubber or fiber, sufficiently large, should be used to handle the plate comfortably with just enough margin for removal and replacing them for examination while in the process of development. An adequate amount of developing solution should be freshly prepared each time, according to the size of the plate to be developed. The amount of solution should be sufficient to cover the whole plate at one time, so as to prevent unequal development. The temperature of the solution should be between 60° and 70° F. and the tray which contains the plate should be rocked occasionally to assure complete development.

X-ray negatives of abdominal and pelvic regions should be carried to almost complete opacity in order to bring out all details (and exposures of parts of lesser density in proportion).

After development the negative should be washed in clear water for a minute or so, in order to free it of all developing solution, and then placed in acid fixing bath until completely fixed, or, in other words, until the bromid or chlorid of silver salts unaffected by the light have been dissolved, changing the opaque parts of the plate into transparency.

The formula of the developer and fixing bath is as follows:

#### DEVELOPER.

Water, 16 ounces.

Tolidol (Pfabe), 40 grains.

Sodium sulfite, dried 45 grains; or crystal, 90 grains.

Potassium carbonate, dried 60 grains; or crystal, 75 grains.

Potassium bromid, 1/12 grains.

To prepare a stock solution it will be found convenient to multiply the above figures by three (3), using the same amount of water. The bottle must be well corked and filled up to the neck. For use, dilute each ounce of the developer with two (2) ounces of distilled water only. The formula for the stock then becomes (in the metric system):

|                                   |      |
|-----------------------------------|------|
| Water .....                       | 500  |
| Tolidol .....                     | 8    |
| Sodium sulfite, crystals.....     | 18   |
| Potassium carbonate, crystals.... | 15   |
| Potassium bromid .....            | 0.15 |

#### FIXING BATH (Pfabe).

|                                                                |     |
|----------------------------------------------------------------|-----|
| 4 ounces sodium thiosulfate, $\text{Na}_2\text{S}_2\text{O}_3$ | 120 |
| 1 ounce sod. acid sulfite, $\text{NaHSO}_3$ ..                 | 30  |
| 16 ounces water .....                                          | 480 |

The fixing bath will be in the neighborhood of 72° hydrometer test.

After complete fixing, the plate should

be washed in running water for at least an hour, or placed in a chemical solution known as "Pfabé" hyperfore (eliminator of hypo) for about ten minutes. After removal the film should be carefully rubbed off with wet cotton in order to remove the sand, etc., that may have settled on it during the washing, then place on an inclined plane to dry, out of the way of all dust.

An x-ray plate should be developed only by one versed or familiar with anatomic structure and physiologic functions.

What has x-ray photography taught us, or what has it disclosed?

In fractures it is an indispensable aid and the surgeon who today would set a bone without availing himself subsequently of the x-ray for verification or for actual diagnosis is certainly not doing his duty to his patient.

In lung and heart diseases we are able to tell much.

In diseases of the kidneys, especially sarcoma, it is of inestimable value.

In ureteral and vesicle calculi it is positive as to the presence or absence of a stone.

In hepatic calculi it is a great aid, but we can not positively differentiate the stones from the gall bladder itself, due to the fact that a gall bladder that is diseased offers as much resistance to the x-rays as the gall stones do. Consequently we get the shadow which corresponds with the gall bladder itself. The possibility of a burn is practically nil.

I would like to call to your notice a few cases of Dr. Byron Robinson of ureteral and hepatic calculi that were x-rayed in Dr. Pratt's laboratory and a diagnosis made from the shadows and confirmed by operation during the past two years and a half.

September 4, 1901. Mrs. S. was x-

rayed at three different times. Diagnosis, stones in the right pelvic ureter. Operated upon and three stones removed.

June, 1903. Girl, twenty-two years old, from Iowa, x-rayed and diagnosis of stone in the ureteral pelvis. The case was operated upon and the stone was found.

October 28, 1903. Mrs. H., of Chicago, was x-rayed and diagnosis of the stone in the right ureteral pelvis. Operated upon and the stone found.

April 4, 1903. Mrs. W., of Chicago, was x-rayed and diagnosis of a stone in the left ureteral pelvis. Operated upon and stone secured.

October 28, 1903. Mrs. H. x-rayed, stone in the right ureteral pelvis. Operated upon and the stone was secured.

November 10, 1901. A young woman, twenty-five years old, x-rayed and diagnosis of gall stones made. Was operated upon and a large stone was removed from common duct.

April 7, 1903. Mrs. W., fifty-five years of age, x-rayed and diagnosis of gall stones. Operated upon and fifty stones were removed from the gall bladder and common duct.

November 10, 1903. Mrs. C., forty-eight years old, x-rayed and diagnosis of gall stones. Operated upon and eight stones secured.

July, 1903. Mrs. W., twenty-six years old, x-ray disclosed a distinct shadow. Operated upon and secured a large gall stone from the pelvis of the gall bladder.

October, 1903. Mrs. H., of Chicago, x-rayed and diagnosis of stone in the pelvic spindle of the ureter. Operated per vaginam and stone secured.

September 30, 1903, and January 24, 1904. Will also report two cases of malignant kidney which were x-rayed and a diagnosis made of malignant kidney by the x-ray. Operated upon by Dr. Robin-



son and subsequent microscopic examination disclosed the fact that the disease in one case was sarcoma, the other carcinoma.

I still have several other cases in which the x-ray by repetition casts a shadow of definite contour, location and dimension. However, they have not been operated upon.

March 17, 1903. Boy, eight years old, a case of Dr. O. W. MacKellar, was x-rayed; diagnosis, vesical calculi. Operated upon and two large stones removed.

One has to be extremely careful in arriving at an absolute diagnosis of ureteral calculi, even where the shadows are present after being x-rayed, because there are other conditions in the same region which do cast shadows. As an example:

Dr. Byron Robinson sent a case in which he suspected calculus in left ureter. X-ray, repeated three times, showed five shadows in course of the left pelvic ureter. The case was operated upon by Dr. Byron Robinson and by exposing the entire left ureter demonstrated that these shadows were caused by phleboliths or vein stones and not calculi, as was supposed.

Before operating one should confirm the diagnosis of ureteral calculi from an x-ray standpoint by a complete history of same and also by ureteral catheterization. The diagnosis can be very successfully verified in this way where the stones are located in the pelvic spindle of the ureter, because they offer obstruction to the catheter.



**The Apostoli Treatment.**—G. Betton Massey (*Journal of the American Medical Association*, May 21, 1904) summarizes the final results of this method of treatment in some cases of uterine fibroids. His conclusions are as follows: (1) A prolonged observation of cases of fibroid tumors of the uterus under the Apostoli treatment teaches that three-quarters of the cases subjected to this method will be practically cured, as attested by inquiries made from three to sixteen years after the cessation of treatment. (2) The cases that responded poorly, or not at all, to this treatment are not harmed by it, when properly applied, and heroic measures may then be adopted with the certainty that milder means are of no avail. (3) Hemorrhagic and interstitial fibroids are

best adapted to the Apostoli treatment, while subperitoneal or degenerative fibroids and those complicated with pyosalpinx are least adapted to be relieved by it. (4) So far as the author's inquiries and circulars show, there have been but seven deaths among one hundred and ten patients during the sixteen years or less that they have been under his observation. It is an interesting fact, moreover, that but one of these deaths was due to the progress of the growth itself, proving the non-mortal character of this affection. Of the remaining six, one died long after treatment of an affection totally unconnected with the growth, one of septicæmia under electric treatment and four while under operation with the knife.—*Medical Record*.



## Electro Therapy.

A Course of Twenty-four Lessons under the auspices of the Chicago College of X-Ray and Electro-Therapeutics.

### Lesson 12—PHOTO THERAPY.

Light consists of electromagnetic waves, and its therapeutic effects are similar to those of rapid electric oscillations of any other kind, such as are found in the high frequency currents and the x-rays. The differences in the effects arise from differences in the form and frequency of the waves.

It is probable that in ordinary light, in the high frequency current, in the x-rays, and perhaps in the N-rays, we have waves of one principal form which, according to the vortex theory, is of the cylindrical type. Other forms which exist are the plane-polarized wave, in which the motion of the ether is in one line only, perpendicular to the direction in which the wave advances; elliptically polarized waves, in which each portion of the ether instead of moving to and fro in a single line moves in an ellipse, and of which there are two varieties, one right handed, the other left handed; circularly polarized waves, in which the ether moves in a circle and of which also there are two varieties; and finally compression waves, whose existence must be considered possible and probable, but of which we have as yet no experimental evidence. Therapeutically the form of the wave is of small importance.

All electromagnetic waves travel thru the ether at the rate of 300,000 kilometers per second. Thru masses of matter, whether in the solid, liquid or gaseous form, they travel more slowly, and the shorter waves are usually retarded more than the longer ones. White light consists of a mixture of waves of many different lengths. Each wave-length by itself corresponds to a certain color. The shortest visible wave is in the extreme

violet end of the spectrum; its length is nearly 400 bicrons (micro-millimeters). The longest visible wave is the dark red at the other end of the spectrum; its length is 760 bicrons. Thus the visible spectrum covers nearly one octave of color. Beyond the visible spectrum at each end are other waves of "dark light." Ultra-violet waves have been photographed of all lengths from 400 bicrons down to 100, covering two full octaves of light, and there is no reason to think that the possible limit has been reached. At the other end of the spectrum, in the infra-red region, waves have been detected of all lengths down to 24,000 bicrons or 24 microns, a distance of five octaves. The whole of the known spectrum of light consists of about eight octaves, of which less than one octave is visible.

Entirely beyond this photographic spectrum, and at a distance of eight or ten octaves from its longest waves, we place the Hertizian electromagnetic waves, whose length varies from a few centimeters to millions of kilometers.

The x-rays are supposed to lie beyond the ultra-violet. The place of the N-rays is unknown.

The general nature of the effects of ether waves upon the body are the same whatever the wave length. But certain rates of vibration affect certain tissues more strongly than others, owing to differences in their chemical and anatomical composition. Wave length thus becomes a consideration of great therapeutic importance.

Waves whose period of oscillation is such that their energy is all expended in any of the tissues do not pass thru those tissues, but are wholly absorbed in them.

Certain of these produce chemical changes, all the rest produce mainly heat. As suggested by J. Mount Bleyer, the phototherapist of the future will filter out all but the rays he wants to use in any particular case, and with this small remnant he will get the desired results with the least possible disturbance to the rest of the organism. In order to reach internal organs it is necessary to use waves of such a character that they are not chiefly absorbed near the surface.

Sunlight does not pass freely thru the body, tho it does so to some degree. The greater part of it is converted into heat in the epidermis and dermis. Hence the therapeutic action of light is greatest in diseases of the skin and of the parts adjacent to it. It has been found that excessive heating of the skin by sunlight is not advantageous, and that this can be prevented to a great extent by filtering out all the rays below the blue. The blue, violet and ultra-violet rays expend a much larger proportion of their energy in chemical effects and a smaller amount in heat. But in screening off the lower waves nine-tenths of the total energy of the light is often lost, leaving too little to be of much value.

Finsen adopted the plan of keeping the exposed parts cool with a stream of cool water, and in this way was able to make use of the full beam of concentrated sunlight or electric light for the cure of various diseases of the skin.

The most conspicuous chemical effect of ether waves upon the body is acceleration of the normal metabolic changes, which may be roughly summed up in one word—oxidation.

A mild stimulus to metabolism, such as is obtained from moderate exposure to scattered sunlight in summer, is a tonic. More intense light is irritating, producing

successively the well known stages of inflammation and culminating in some form of necrosis when the intensity becomes sufficiently great. The general nature of the effects are alike upon both normal and abnormal tissues; but abnormal tissues have less vitality, in other words, are in a less stable condition of chemical and physiological equilibrium, and therefore pass thru these changes more rapidly or with a less intense stimulus than normal tissues require. If, then, we apply the light with just enough intensity to injure and destroy tissues that are abnormal, taking care not to have such intensity as to seriously injure the normal, a cure is effected.

The plan of procedure is then very simple, namely, avoid excess of heat, use light with increasing intensity until the desired reaction is obtained.

It makes little difference whether the apparatus costs one dollar or a thousand dollars, so long as these two things can be done. Sunlight is the best when it can be obtained; but so long as we are unable to control the clouds it will be necessary to have on hand some other source of light. The electric light is practically the only one that is of sufficient intensity, and that can be made use of at a moderate expense. It has the advantage of containing a good supply of violet and ultra-violet rays, without which its therapeutic value would be small. The nearer the source of light is to the part to be treated the greater is the intensity of the treatment. If the source is removed to twice the distance the intensity of the light becomes one-fourth of what it was.

Sometimes the light is concentrated by passing the rays thru a lens so as to render the rays parallel. They can then be transmitted to any required distance with-



out much loss of intensity. Unfortunately, glass is opaque to most of the ultra-violet rays, and it is necessary to use a lens of quartz. The apparatus becomes much simpler and much less expensive when two quartz plates or lenses enclose a chamber thru which a current of cool water flows. The chamber is placed preferably in contact with the patient, with some pressure, so as to remove the blood and allow the rays to penetrate more deeply. The source of light is then placed as close as possible to the water-chamber, or the rays of the sun are concentrated upon it by means of either a large quartz lens or a concave metallic mirror.

Some experimenters advise the use of a powerful ray directly upon the surface to be treated, and used intermittently in order to prevent overheating. They claim for this treatment quicker results than by the Finsen method, which consists of a longer exposure under less intensity.

On account of the great expense of the original Finsen lamp, both in first cost and in operation, a number of smaller lamps for individual and local treatments have been constructed. These are ef-

ficient in proportion to the amount of light produced by each. An electric lamp requiring five amperes current is useful for mild cases. A lamp using fifteen to twenty amperes, and which can be brought close to the patient, has nearly the same efficiency as the larger Finsen apparatus.

The considerable work has been done in photo-therapy, except from Finsen's laboratory we have no very extensive and reliable statistics from which we may infer the value of this agent in different diseased conditions. There is no doubt of its value in the treatment of lupus, and good results are claimed in the earlier stages of tuberculosis of the lungs and of the joints. In some cases of malignancy the alternation of the x-ray with light has proved more effectual than either one alone. Careful experimental investigation is still required in order to determine more exactly the proper exposure under different conditions as regards the patient and the disease. Practically no harm has resulted from the experiments in photo-therapy, because when the treatment becomes injurious the patient immediately begins to object on account of the severe pain.

#### High Frequency for Lupus, Etc.

Dr. H. L. Henderson, Astoria, Ore., contributes to the *Eclectic Medical Journal* for March a report of the cure of lupus of the face, of fifteen years' standing, in seven treatments with the high-frequency apparatus excited by a static machine. A case of epithelioma of the eyelid, with an ulcerating surface the size of a dime, disappeared in seven treatments. Three large rectal ulcers disappeared after five treatments. A case of chronic ovaritis was cured in two weeks by daily treatments.

#### A Convenient Method for the Local Application of Dry Heat.

Cover the part to be treated—wrist, elbow, ankle, knee or body, with a Turkish towel to absorb the perspiration. Coil twenty yards of rubber tubing about the part to be treated and cover snugly with woolen cloths to retain the heat. Pass a stream of warm water through the tube, gradually increasing its temperature. A patient can stand all the heat that you can give him, if you do it right, and it's *dry heat* except for his perspiration.—*Alkaloidal Clinic.*

# **The Cure of Consumption by Feeding the Patient with Subcutaneous Injections of Oil, and Its Digestion by the White Globules of the Blood.**

BY THOMAS BASSETT KEYES, M. D.,  
OF CHICAGO,

Chairman of the First Organization Committee of the American Congress of Tuberculosis, and One of the Vice-Presidents of the International Congress of Tuberculosis, St. Louis, 1904

By the method of treatment which I am about to describe in this paper I believe that consumption can be absolutely cured. First, however, before entering into the merits of this treatment, let us briefly consider the disease.

Tuberculosis is a disease of malnutrition, and while the presence of the germ confirms the diagnosis, before the germ can grow it must find a suitable soil, there must exist a pretubercular condition. It is estimated that we all breathe in a great many of these germs, but that they can not grow in a healthy, well-nourished individual. People who have consumption do not eat fats, oils and cream in sufficient quantities. The first requisite in an attempt to cure tuberculosis has been for many years to give the patient oils of various kinds, and the most successful sanitariums of late years have adopted a process of food forcing, using the fats of meats, butter and cream as the principal foods to be relied upon to effect a cure, each article of diet being selected for its fat-producing and strength-giving properties. To this a vigorous out-of-door life has been advocated, because why? It promotes appetite and the outdoor life is conducive to place the body in condition for the absorption of more fats. I was one of the first to advocate tent life for the treatment of tuberculosis in two articles entitled: "Camp and Outdoor Life as an Aid to the Permanent Cure of Tuberculosis, February 21, 1900," and "Some Results of Camp and Outdoor Life in North-

ern Wisconsin, Congress of Tuberculosis, May 15, 16, 1900," and some four years ago I located an out-of-door camp for the treatment of these invalids in Northern Wisconsin.

To maintain nutrition has long been considered the prime requisite of cure and an increase of weight is an indication that nutrition is overcoming the disease, and as weight increases there comes strength, and the passing away of the other distressing symptoms, such as the products of the disease, expectoration of mucus, fever and finally cough. Professor Osler has stated that the arrest and cure of the disease is entirely a matter of nutrition and that the whole object of treatment is to fortify the patient's constitution against the inroads of the disease so that the individual cells of the body have the stamina to fight against and destroy the tubercle bacillus. Regarding tuberculosis Dr. J. H. Elliot, in *Canadian Journal of Medicine and Surgery*, March, 1903, says that nutrition is dependent upon the proper assimilation of food, while improvement must be proportionate to the increase in the amount assimilated. All therapeutic measures, says Marfan, should be devoted to the end of nutrition and the earlier such measures are instituted the greater the prospect of cure. Without going further into the fact that the whole cure of tuberculosis, up to the present time, is dependent upon our ability to nourish the patient, except to say that the methods of Dettweiler, VonLey-

den and Hoffman, of Germany, depend upon results from nutrition, and to this end they have advocated forced diet regardless of appetite. If the patient was to recover he must eat. Out-of-door life was important inasmuch as it supplies to some extent the appetite.

Anorexia is one of the worst symptoms against the cure of tuberculosis. It is impossible to get the average patient to eat enough fats, and a person who has consumption is the one who leaves the fat from his meat, eats very little butter, and little of cream and milk. When a patient is far advanced in the disease he is unable on account of this loss of appetite and nausea, to eat sufficient food to maintain nutrition, and therefore gradually declines as the disease advances.

In the above few words I have tried to convey the importance of nutrition, in the cure of this disease, believing that the cure rests entirely upon our ability to so nourish the system and stimulate the cells of the body that they will throw off the disease.

*The Digestive Power of the White Blood Cells.*—Experiments have been conducted principally by the Italian physicians, and a few others, viz.: Gabrelschewski, arch. f. exp. path. 1891, bd. 28; Czerny, arch. f. exp. path., 1893, bd. 31; Leviertato, arch. Italiano di Clinica Medica, n. 3, 1893; Tarchettia e Parodi, La Clinica Medica Italiana, n. 10, 1899; Kraminer, Berl. Klin. Woeh., n. 6, 1890; Oliva, Gazzetta Degli Ospedali, 17 giugno, 1900; Tarchetti C. Sull' esistenza di un fermento diastace nei corpuscoli bianche, Gazzetta Degli Ospedali, n. 90, 1900; Sull natura e sul significato della sostanza iodofila dei globuli bianchi. La Clinica Medica Italiana, n. 8, 1900; Di una pretesa degenerazione amiloidea sperimentale, La

Clinica Medica Italiana, n. 7, 1900; Ricerche sulla degenerazione amiloidea spermintale, La Clinica Medica Italiana, n. 11, 1902; Porcile V. sul valore semeiologico della reazione iodofilia nei purulenti, Gazzetta Degli Ospedali, Milano, n. 102, 1900, which go to show that there is a glycogenic ferment in the cells which has the power to digest starches. These experiments have been carried on principally to discover a cause for the disease of diabetes. It has been shown more or less perfectly by some of these same observers that fats also may be digested by the blood, and that the white blood cells have the power of digesting oils. Though these experiments, according to Tarchetti, La Clinica Medica Italiana, 1900, are not definite, it is clear that the white cells of the blood possess a ferment or property which has the power of digesting fats and starches, and without going into the process, chemical, phagocytic, osmotic, etc., which has been gone into by Dr. Spezia in the numbers 5 and 6 of the Gazzetta Medica Lombarda, 1904, for as Tarchetti, Gazzetta Degli Ospedali, n. 28, 1904, says: "Is it possible to follow the rapid course of the oil injected into the internal organism and the phenomena positively chemical, of osmosis, of phagocytosis, and of digestion intercellular?"

Upon the digestion of oils by the blood I base this claim for a cure of tuberculosis. So far I have tried to show: First, That the cure of consumption must necessarily depend upon a proper supply of nutriment, the disease being primarily a disease of malnutrition. Second, That consumptives suffer so much from loss of appetite, nausea, and perhaps non-absorption, that, as a rule, they are unable to take sufficient amounts of fats to overcome the disease. Third, That the blood cells possess a ferment capable of digesting fats.



I shall now give my results in the cure of tuberculosis by the subcutaneous injection of oil. The oil which I have selected in the treatment of my cases has been olive oil of a very high grade, thoroly sterilized, using olive oil in preference to other oils on account of its being non-irritating and very readily accepted by the system. The point selected for the injection has been over the shoulder blades, injecting one day over one shoulder, and the next day over the other; excepting when a large amount of oil is used, when it is necessary to inject over both. There is very little pain connected with the injection and the following day it is hardly possible to find where the injection was made. By being careful in my technique of cleanliness and sterilization, so far no infection has taken place and consequently no soreness, though I believe the non-irritating properties of the oil have a great deal to do with this. The amount of oil used varies. I commence by injecting 12 cc. of oil each day and the third day increase the amount to 24 cc. of oil. If no unpleasant symptoms arise I keep gradually increasing the dose to full tolerance of the patient, which varies with the individual and the stage of the disease. Those who are poorly nourished will sometimes assimilate large quantities of oil up to about 200 cc. daily. In this manner I have treated nine consecutive cases successfully, and within twenty-four hours after each treatment there is a remarkable benefit and amelioration of all symptoms, such as diminished morning cough, night sweats, increased strength, and finally gain in weight. Some of the very worst cases of tuberculosis, under this plan of treatment, have gained each day and I believe have been thoroly cured. The syringe which I use is an aspirating

syringe reversing the piston with a thumb screw, it requiring considerable pressure to force the oil under the skin.

By injecting oil thus it is absorbed and assimilated by the blood cells and there is a great increase in their numbers. Thus all of the indications for the cure of tuberculosis are met. It overcomes the disease thru increased phagocytosis and thus the active cells destroy the disease. Nutrition is re-established. The time required to overcome all symptoms is remarkably short and one will be greatly surprised at the benefits which come with each treatment. Physicians should use great care in the amount of oil given, for very large doses, if long continued, might result in fatty degeneration of certain organs, but with the disease (tuberculosis) this is not so apt to occur, as tuberculosis and fatty degeneration are antagonistic. I have based the claims of this treatment as a cure for tuberculosis from my experience and clinical evidence and from my conviction. I give my results this early, believing that the cure of tuberculosis is solved and that by so doing many lives will be saved. Of course, to the above treatment should be added all that has been found useful in the treatment of tuberculosis, principally of which is a forced diet of articles selected for their nutrition, such as meats, fats, butter and cream, out-of-door life, and hygiene.

I hope and trust that physicians will at once take up this method of cure and I respectfully request that those doing so will communicate their results to me, as by broader knowledge much good may come and it is my desire to report these results at the International Congress of Tuberculosis, to be held in St. Louis this year.—*Pacific Medical Journal*.

## A Brief Review of Radium.

BY HENRY E. WAITE, M. D.

Let us not approach the consideration of this most recent addition to therapeutics with the blind faith of those who would believe that with the discovery of this new substance comes the dawning of the day when the blind shall be made to see, the lame to walk, when we shall mark the passing of all diseases due to parasites and bacteria, when tuberculosis shall be as a thing that was, and when the cure of cancer—that goal toward which modern scientists so earnestly strive—shall be an accomplished fact beyond doubt or peradventure.

Nor yet should we view it with the skepticism of those who, having suffered failure in inappropriate cases, would forthwith banish it to the limbo of the many measures previously exploited which have been tried, but have been found so woefully wanting.

Let us rather regard it with a sane, calm and impartial judgment, appreciative of its limitations, but keenly alive to its marvelous possibilities. While we may not as yet have a slingshot sufficiently powerful to slay outright the Goliath, disease, we may perchance be in possession of an arrow, which, skillfully directed, may pierce a vulnerable spot.

So numerous have been the articles appearing in both scientific journals and the lay press that radium has become almost as familiar a term as *sapolo*, and a brief mention of its physical properties will, therefore, suffice.

As Dr. Hedley says, in this substance we seem to approach the border line where matter ends and force begins. Indeed, one theory assumes that radium is a metal in a transition state, which may eventually establish a new atomic equilib-

rium and assume again the common properties of a metal.

To Professor and Mme. Curie belongs the credit of priority of discovery of this new element, for an element it has been proven to be by the spectrum analysis. By tireless effort they extracted from many tons of uranium residue, obtained from pitch-blende, two decigrammes per ton of a product of enormous radio-activity. Radium bromid is the strongest salt, but only infinitesimal quantities of this have thus far been produced.

Radio-activity is rather arbitrarily expressed in figures. Uranium is taken as unit strength and the radio-activity of radium is represented by 1,000,000. Upon this basis the preparation of radium thus far used for medical purposes would be said to have a radio-activity of 1,000 to 19,000. In some instances, however, the question of the radio-activity of a given specimen is a mooted point. I call to mind one instance in which the proud possessor fondly imagined himself to be experimenting with a specimen of a radio-activity of 20,000, which, upon careful testing, proved to be but 600!

A peculiar property of radium is that it is able to maintain its own temperature at  $2^{\circ}$  to  $3^{\circ}$  F. above the surrounding air without deriving its heat from any apparent source. Various theories as to the cause of this have been formulated, but as yet none of those advanced are entirely tenable.

The emanations from radium are divided into three groups, and although they resemble Röntgen rays to some extent, they are in other respects dissimilar. The classification is as follows:

A-emanations not affected by an ordinary strong magnetic field and incapable of passing through any but the very thinnest material obstruction. Altho of very much less penetrating power than the next group, they have about 1,000 greater energy.

$\beta$ -rays, analogous to kathode rays, are deflected by a magnetic field, have greater power of penetration and are projected from radium with a velocity approximating that of light.

$\gamma$ -rays are the most penetrating of the radium emanations and are analogous to Roentgen rays. They are considered as vibrations of the ether, produced by the sudden arrest of the electrons, the "kathode stream," coming into contact with solid matter.

Deflectable emanations affect a screen of barium platino-cyanid strongly, and of zinc sulf. only slightly; the non-deflectable positive atoms ( $\alpha$ -rays) have comparatively little effect on the platino-cyanid, but powerfully affect the zinc sulf. If a particle of radium nitrate be brot to bear upon the latter and the surface be examined with a lens magnifying about 20 diameters, numerous bright scintillations will be seen, due probably to the bombardment of the screen by positive atoms projected from the radium.

Investigation has shown that emanations from radium have the power of discharging electrified bodies; they also possess photographic and flourescent effects, an oxidizing action and the power of converting oxygen into ozone. An article in a recent journal demonstrates that the different components of this complex radiation possesses these powers in varying degrees. It is stated that  $\alpha$ -rays coagulate electrically negative colloids, and dissolve positively charged colloids, while  $\beta$  and  $\gamma$

rays produce chemical changes and oxidize tissues.

The power of discharging electrified bodies is an easy test for radio-activity. A stick of sealing wax rubbed on flannel is capable of attracting pieces of thin paper, but if the rubbed sealing wax be passed over radium this power is lost.

It is claimed that the emanations from radium have a bactericidal effect, it being shown in many instances that the organisms were killed in those places where they had been exposed to the action of over 10 milligrams of radium bromid. The organisms so affected were bacillus coli communis, bacillus liquefaciens and bacillus prodigiosus.

Concerning the physiological effects of radium not much is definitely known. It will produce luminous effects upon the closed eye, supposed by some to be due to flourescence of the membranes and by others to an action on nerve centers. It is this fact which has led to the exaggerated claims of the usefulness of radium in blindness, none of which have as yet been substantiated. There is no virtue in radium to restore sight, although it may be employed as an indication whether, as in cataract, the optic nerve is or is not intact. Other methods are, however, at our command for the same purpose, and, indeed, the danger attaching to the promiscuous use of radium for such purposes will preclude the possibility that it will ever become very extensively employed for this except in the hands of experts.

Burns similar to those of x-rays are produced upon the skin, the museles being more resistant. It has been observed that atonic ulceration, lasting five or six months, has been produced by too prolonged exposure to radium. So, even though it should become cheap and abun-



dant, unless means are devised for the mitigation of this danger, its use must still be restricted to certain well-defined cases.

Entering now upon the discussion of that which concerns us more directly, i. e., the therapeutic effects of radium, these must of necessity vary with the radio-activity of the salt used, the method of its application, the condition of the part, the length of the exposure and the distance from the surface treated.

Two methods may be employed according to the nature and requirements of the case; short and repeated exposures and prolonged applications producing ulceration.

Experimentation with this new substance is still in so crude a stage that there is as yet no great variety in the method of application. The salt has usually been put up in a glass tube and the application made by holding the tube to the skin. As further work is done along this line it is quite probable that many other and more convenient, accurate and effective methods will be suggested.

As to the theory of its action, Exner and Holzkecht consider that "radium rays irritate the cells of the strata of the skin less vehemently than they irritate the cells of cancer and sarcoma. The latter are brought to necrosis before the other tissues suffer severely from the effects." Others hold that we have in the various forms of radiant energy the power of checking, or of attenuating, or of rendering the tissues resistant to the growth of certain parasitic organisms.

The number of those who are experimenting with radium is large, but up to the present the percentage of authentic cures is small. Many there be who rush into print with incomplete details, but with fantastic theories, and we would do

well to weigh the evidence carefully before deluding ourselves with the idea that we have here an agent more powerful for good than subsequent developments may prove it to be.

Current literature reports a number of cases of lupus in which radium has been curative. Dr. Danlos, of the St. Louis Hospital, Paris, is inclined to be rather more conservative. He states that while it looks as though radium would cure lupus, and that there is every reason to believe that it may do for lupus all that the Finsen light will do for it and do it more quickly and simply, still there have been some relapses and some failures, and he considers it too early to make sweeping statements which may only arouse false hopes.

Cases of psoriasis, rodent ulcer, melanoma, carcinoma and epithelioma are also reported, in some of which the results would seem to be brilliant and encouraging. There is, however, a lack of uniformity and a paucity of detail which would engender the hope that experimentation might be conducted under more definite conditions, on carefully diagnosed cases, and that the radio-activity of the salts employed might in each instance be given, so that the data might be of more practical value.

It would seem that radium should be especially valuable in the treatment of deep-seated malignant growths inaccessible by other means, but experience seems to show up to the present that for the treatment of superficial lesions in accessible locations, the x-ray is equal, if not superior, to radium, the treatment by x-ray having the additional advantage that the exposure required is only two or three minutes, while an equal effect from radium requires an application of at least half an hour. Dr. Abbe mentions a com-

parative test in the case of a man attacked with epithelioma simultaneously in both ears, one of which was treated with radium and the other by means of the x-ray. A cure followed in each instance, the only difference being in the length of time required for treatment.

We may no more hope to cure every case of cancer by means of radium than we may hope to cure every case of headache by means of the correction of errors of refraction, and we are still face to face with the fact that we have not yet found that cure-all so earnestly sought, but that radium will only cure in some instances and that we will still continue to meet cases not amenable to treatment by radium or anything else.

In view of the fact that the emanations from radium have been shown to have a certain bactericidal effect, the ground has been taken that radio-active air taken into the lungs should prove effective in the cure of tuberculosis. It may be that the theory will stand analysis, but as yet we have no definite data upon which to base conclusions.

The study of this fascinating element is as yet in its infancy and it is quite probable that within the next few months numerous startling theories may be advanced, many of which will doubtless be speedily abandoned as unsound, but let us hope that with the lapse of time there may be the promulgation of sound theories and that conscientious and painstaking experiment and clinical data may show that we have in radium an invaluable addition to modern therapeutics.—*The Electric Review*.

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**The Use of Radium in a Case of Rodent Ulcer.**—J. A. B. Hammond reports (*British Medical Journal*, April 23,

1904) the following case: The patient was a man of eighty-five years, and was suffering from rodent ulcer. When first seen by the writer it was the size of the top of a teacup, but limited to the area supplied by the second division of the fifth nerve. It was determined to try the effect of radium bromid. A small tube of 5 milligrams was used. Treatment was begun by giving an exposure daily of fifteen minutes, holding the tube within half an inch of the ulcer, without any screen, and slowly moving it over the surface. After four or five days, altho there were no visible effects, the patient said the pain was less troublesome; and the exposure was then given twice a day. The discharge which had been considerable, rapidly decreased. The granulations were more healthy, but the edges of the ulcer remained unaffected. The patient finally refused to be bothered with any treatment at all. Since then the ulcer has spread deeply, the pain increased, and the discharge returned. This proves that even in such a desperate case as this, radium has a distinctly beneficial effect.—*Medical Record*.

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#### **Treatment of Cancer with Radium Bromid.**

Mr. H. G. Plimmer, of the Lister Institute of Preventive Medicine, relates, in the *Lancet* of April 16, the results of experiments carried out by him, with radium bromid on seventeen cases of cancer at the Cancer Hospital, London. The amount of radium used for these cases was 30 milligrams. The cases made the subjects of experiment consisted entirely of carcinoma, many of them being in a very advanced condition. The individual exposures varied from forty minutes to five minutes, and the capsule containing the radium was placed directly on the nodules or lumps, the only thing intervening be-

tween the radium and the skin being the tale top of the capsule. The cases were left for a month after the exposures and then examined. The effects in all the cases were negative, either no change or an increase in the size of the nodules. The effect on the skin varied in the different cases; an exposure of ten minutes was generally sufficient to produce blistering, and then scabbing, and under the scabs there was found a very slowly-healing ulcerated surface. The radium had apparently no effect with regard either to causing or relieving pain, and the irritation of the blisters was slight. From three of the above patients, who died, some of the nodules which had been treated were excised and subjected to a careful microscopical examination. In all these cases no change was found either in the cancer cells or in the fibrous tissue and none were degenerated. There appeared to be an increase in the amount of the subcutaneous rounded exudation which was greater in amount in those nodules which had been more recently treated, but the irritation of the skin would sufficiently account for this. Dr. Apolant, writing from Professor Ehrlich's laboratory, records, in a recent number of the *Deutsche medizinische Wochenschrift*, some very satisfactory and striking results obtained by treating very rapidly growing nodules of inoculated cancer in mice. Professor Exner, in Vienna, arrived at similar results in a case of melanotic sarcoma with multiple rapidly growing nodules in the skin. Mr. Plimmer says "it appears as if the emanation from radium can only act upon young and rapidly growing cells, and that older cells, especially if surrounded by fibrous tissue, are less and less easily affected, and if there be an excess of fibrous tissue the cells are not at all affected."—*Medical Record*.

#### Radium and Terrestrial Heat.

Professor Rutherford, of McGill University, Montreal, in a lecture before the Royal Institution in London, has advanced the striking theory that the earth's heat is not attributable to a molten mass which has been slowly cooling for a million years, which has been the generally accepted theory, but to the presence of radium. Professor Rutherford's address was listened to by a distinguished audience, including Lord Kelvin, Lord Rayleigh, Professor Dewar and other great scientists. Professor Rutherford was the first to measure the mass and velocity of the electrons of radium. He announced the probability of radium being contained in all matter.—*Electrical World and Engineer*.

**Effects of the Roentgen and the Radium Rays on Cell Division**—Perthes claims (*Deutsche medizinische Wochenschrift*, April 28, 1904) that both of these rays have a well marked inhibitive effect on division in both animal and plant cells. Observations made on the developing eggs of "ascaris" show that the x-rays exert a distinct harmful effect, independently of whether nuclear division has begun or not. The damage does not appear at once, but comes on later as cellular division proceeds, and is marked by an irregular course in the development and the production of abnormal end products. Analogous results were obtained when the radium rays were employed. Exposures of growing plant roots to the influence of both varieties of rays also disclosed a marked inhibitive action on their growth. The author suggests that the effects are due in all probability to the production in the living cell by the rays of substances which damage the chromatin in the nucleus.—*Medical Record*.



### Effect of the X-Rays on the Internal Organs.

II. Heinecke (*Münchener medizinische Wochenschrift*, May 3, 1904) in some experiments made about a year ago, found that small animals exposed to the rays for a number of hours, died in from seven to fourteen days. The spleen showed an excessive increase in the pigment, a disappearance of the follicles, and a destruction of the splenic pulp. More recently he extended his experiments and exposed a larger number of animals of about the same size. He then found that it was possible to separate entirely the processes in the follicles from those taking place in the other parts of the spleen. The former started a few hours after beginning the radiations and were completed in twenty-four hours. The nuclei of the lymphocytes in the follicles disintegrate within a few hours and the remnants are taken up by the phagocytes, which shortly disappear from the spleen. This results in an almost complete destruction of the follicle. Analogous processes are also found to take place in all other lymphoid structures of the body. In the marrow similar processes occur. When larger animals, such as the dog, were employed for the experiments, the same results were obtained, except that the time was slightly prolonged. It was determined that the minimum length of time required to bring about these changes was fifteen minutes in rabbits or a moderate size dog. For these short exposures the amount of destruction is limited and repair can undoubtedly take place. These experiments show that there are cells in the body which react to the rays much more quickly and delicately than the cells of the epidermis. The author believes that similar effects take place in man, and that the lymphoid structures are affected without there being any marked reaction

in the skin. He therefore claims that a therapeutic application may be made of this principle in treating certain diseases of the lymphatic system—leukæmia, pseudo-leukæmia, malignant lymphomata and lympho-sarcomata. It may also prove of value when the disturbances are due to an abnormally large thymus. He has not made any use of this method himself, but in a footnote refers to cases of leukæmia thus treated by American surgeons.—*Medical Record*.

### Radio Therapy in Pulmonary Tuberculosis.

Karl F. M. Sandberg, Chicago, (*Ill. Med. J.*, March) after a very complete tabulated resumé of the results of x-ray treatment of nearly fifty cases of pulmonary tuberculosis, from the earliest cases treated by Pratt in America and Rendu and Du Castel in France, down to the present time, presents the following conclusions from his survey:

1. No ill results, that clearly can be traced to the effects of the x-rays, have been observed, x-ray burns excepted.
2. Beneficial results have apparently been obtained in a considerable number of cases.
3. The fact that many cases, especially in the latter stages of the disease, have not shown any improvement, not even retardation of the disease, does not detract from the merits of the remedy any more than it detracts from the merits of all remedies previously used.
4. The x-ray treatment should be valued as one of our most efficient remedies in tuberculosis of the lungs, but should not exclude the use of other remedies.
5. The greater uncertainty of the effect of the x-rays on tuberculosis of the lungs, as compared with the effect of tuberculosis of skin, glands, peritoneum and joints, can easily be explained by the ob-

struction placed in the way of the rays by the ribs, an explanation that carries with it a suggestion, namely, resection of the obstructing ribs in appropriate cases before the use of the rays.

6. It would seem that an instrument of medium intensity and medium length exposures carried on for a considerable length of time—months—have given the best results.

#### **Hypnotism in the Treatment of Chronic Alcoholism.**

Hypnotism has been used for some time now in the treatment of confirmed inebriates. Those who have had experience of this form of treatment report satisfactory results. Dr. Milne Bramwell, in his recent work on hypnotism, states that he has treated during the past twelve years seventy-six cases of chronic alcoholism by hypnotic suggestion, and has obtained the following results: Cured, twenty-eight; much benefited, thirty-six; unaffected, twelve. Some of the best results have been with women, a contradiction of the popular theory that women are incurable. Dr. Creed, of Sydney, New South Wales, has recently drawn up a report on drunkenness and its prevention and treatment in that colony. He insists upon the virtue of hypnotic treatment, and urges that the treatment should be tried in the public institutes of the colony, as

well as in private practice, and he is confident it will be found to cure a large proportion of drunkards.

Dr. Charles Lloyd Tuckey, writing in the *British Journal of Inebriety*, April, gives the following as his conclusions reached by a close study of the matter: (1) Most alcoholics are good hypnotic subjects. (2) To insure reasonable prospect of success, the patient should have a real wish to be cured, and should be placed under favorable conditions while undergoing treatment. (3) He should be kept under observation for at least a year, during which time he should feel himself on probation. In the opinion of Dr. Tuckey the treatment has these advantages:

(1) It is rapid in action. After two or three sittings there is generally a marked improvement in the patient's general mental and moral condition. (2) The patient is able to continue his business, and is thus saved the expense and loss incurred by confinement in a retreat. Domestic ties are not broken, and the demoralization which often results from the enforced idleness and evil companionship, almost inseparable from life in a retreat, is avoided. Suggestion should aim at two objects—absence of craving and even physical repulsion toward alcohol, and increase of power of resistance and restoration of self-control.—*Medical Record*.



## Suggestion in the Cure of Consumption.

BY DR. EUGENIE R. ELISCU.  
1519 MADISON AVE., NEW YORK.

In the rational treatment of consumption there are a few important factors to be considered besides proper food, air and surroundings.

The first step is to inoculate, not only the mind of the sufferer, but the public at large, with the conviction that consumption is a curable disease.

Second—That not the disease is to be treated, but the individual.

Third—That Mr. Optimist will recover more speedily under Dr. Altruist's care than Mr. Pessimist.

Fourth—Nature demands the survival of the fittest. And who is he? The one who fits himself with the power of will to conquer in the battle of life. Therefore success does not depend only upon what kind of food, air or exercise one uses, but upon our own desire and will as well as upon the suggestion from within, or without, the bulwark of all therapeutic systems.

In the primitive or savage state, when man led a natural life, breathing pure air, we have no reason to assume that consumption was his companion. Even if the savage passed his nights in some spacious but clean cave, probably there was no one else to pollute or share with him his rocky bed. Besides, with the dawn of day necessity drove him out to exercise his limbs and lungs in search of food, and thus kept him well. While today civilization has unfortunately driven us away from the caves of mother earth into non-aerated and sunless dens, so-called modern flats, there, *en masse*, to send us into early graves by a continuous rebreathing of foul air. These dungeons or pest holes we call human habitations, and then won-

der why consumption and other diseases appear here and there to relieve the congestion, as well as to point out our great social and individual sins. In our selfish ignorance we have forgotten that you and I and all of us are our brother's keepers.

Humanity is a chained unit. If one individual link in the social structure is impaired, sooner or later one by one is doomed to undergo the same fate.

Consumption is a social problem and requires a social remedy. This cancerous growth prevails mostly among the ill-nourished, underfed lower flora of society (the victims of the crowded tenement districts), from whence it spreads its miasmatic poison to the fauna of the upper social structure, polluting the perfume of the high-fenced roses, proving that no one is safe as long as it exists. Nature righteously takes her course and reminds us that unless man will learn to love himself as well as his neighbor he can not hope to exterminate the consumption of hearts, lungs, minds and souls. Suggestion and auto-suggestion are seldom mentioned as causes, but often observed by the general practitioner.

Now we come to the microbic cause—the bacillus tuberculosis. Previous to the era of the microscope we knew nothing of its existence, but ever since we have given it so much importance that from the micro it has grown to a giant macro and rules everything else out. No physician of repute now dares to make a positive diagnosis of consumption unless the board laboratory reports tubercle bacilli. Much less would one dare pronounce a case cured, even in the presence of all the symptomatic evidences of health, until the



board says no germs are found. Bearing this in mind, we think we ought to know something of this much-scrutinized monster.

If the microbe were the chief cause, as by most believed, why by all our daily exposures do so comparatively few contract consumption? Many a consumptive dies without the tubercle bacilli being found in his organs; many a healthy man entertains the germs and still lives. This proves that the cause is not the microbe without, but the man within. Therefore, instead of hunting them down and seeking a counter-poison to kill-cure, two at one shot, let us leave the old beaten track and start anew to learn how to fortify the system against the plague.

Reviewing all the causes and the many disappointments met with in the endeavor to stamp out this disease, it is no wonder that in the mind of many a physician and of the public it is held to be incurable. Yet in the face of all the failures, man, with a bulldog tenacity of faith, hopes against hope to cure an incurable affliction.

From a psychological point of view the question arises, from whence this unreasonable optimism in our hearts? The medical profession gave it its death blow by declaring it incurable. At the same time the profession is still searching for a cure.

Tuberculosis is a culmination of working causes. Remove these and nature will help you to effect a cure. How? By constantly suggesting right thoughts, right living, breathing, eating, dwelling, schooling, marrying, child-bearing, thus curtailing the inner and outer causes. The tubercle, not finding suitable pabulum on which to thrive, will have to die a natural death.

Man's body, the finest living machinery,

made up synthetically from heterogeneous protoplasm, chemically analyzable into elements, microscopically known as a cellular mass, still challenges science to explain the grand processes which continually elaborate the phenomena of life-energy and the manifestation of mind. Man as a complex unit governs his body by means of the brain centers, from whence the invisible force, mind, imparts through the nerve filaments temporary intelligence into each individual cell, receiving in return information as to its condition and requirements. Thus the mind influences and controls the bodily functions. Through the knowledge of hypnotism we also learn that this invisible energy functions on two planes, the objective and subjective, and is amenable to what has been termed suggestion; particularly when the subject is in the passive or psycho-hypnotic state. Through these comes our power of healing.

Suggestion when oft repeated becomes a mental picture impressed upon the sensitive cell plates of our memorizing faculty, from whence it proceeds to manifest, as a part of us, building up or destroying according to the vividness and nature of the suggestion. Suggestion, the moral, mental, physical impetus right, accelerates or inhibits our emotions of body and mind, and thus produces changes in the tissues, organs and vital metabolism.

Often I am asked. Will suggestion or hypnotism grow a new lung? No! Man does not wait to die with both lungs gone, but anticipates that climax. The autopsy table discloses hundreds of cases of persons who reached old age though considerable portions of their lungs were gone. What suggestion does and will do is to stimulate bodily repair by addressing the mind, be it in the waking or psychic state, to direct its invisible accelerating force to

the part, organ or tissue requiring help and thus check further destruction. It has this advantage over medicine: it is harmless and non-depressing. All it requires on the part of the patient is to live an hygienic, natural life, securing plenty of fresh air, proper nourishment and willingness to co-operate with the physician. The physician must not neglect the education of the patient in regard to general and thorough hygiene, otherwise it will only be doing half duty. By the aid of hypnotism we implant and impress post-hygienic suggestion, and by it help the patient to a speedier recovery.

To go into descriptive details as to methods of psychologizing and treatment would require too much time; but will briefly say that as a basis of success the operator must be an individual with strong will power, and must have a thorough knowledge of human nature, in addition to his medical training. This must be coupled with a strong moral conviction and firm resolve to do what is right, and he must learn to vividly impress upon his patient the suggestions he wishes to be realized. Of course, success largely depends upon the susceptibility of the patient and his willingness to act in accordance with surroundings and circumstances, for suggestion will not nourish a body that lacks food or that must breathe foul air. These do not supply what the nature of a healthy body requires. Again, some operators meet with more success than others; this depends upon the individual. But suggestion and hypnotism in the hands of a skillful, conscientious operator are powerful therapeutic agents for good, not only in curing functional nervous diseases right, but also those of organic origin. To my knowledge no other physician has ever claimed to have cured tuberculosis, this being an

organic disease, by means of suggestion and hypnotism. Yet I have used and am using it in both tuberculosis and mental diseases with most happy results. For years I watched and waited to see these results, in order not to prematurely hold out a hope to those poor sufferers, but after long experience I conscientiously feel warranted in bringing them before the profession, leaving investigators to judge for themselves.—*Suggestion.*

#### **Differential Method of Observing N-Rays.**

MACE DE LEPINAY.

A description of a contrast method, by means of which a number of people who could not observe n-ray effects before have now been enabled to confirm them. The method is based upon Blondlot's observation that the impact of n-rays changes the distribution of the radiation from a sulfid screen, increasing it in a direction tangential to the surface. The author mounts two strips of sulfid close together, one of them being a narrow line 2 mm. thick, and the other a strip 25 cm. long, but inclined at an angle of  $1^\circ$  to the line of vision, so as to appear about the same thickness as the former. The two strips are mounted in such a manner that they appear to form the figure 7, the oblique branch being viewed normally. The strip viewed tangentially is made somewhat more luminous than the other, so that the two strips appear equally bright under normal conditions. If now they are simultaneously exposed to a source of n-rays, such as a sounding body, the strip viewed normally is seen to shine out, while the other darkens and sometimes disappears altogether. It is possible, and even advantageous, to employ a luminosity much greater than that ordinarily used in n-ray experiments. The surface viewed tangentially must have a very fine grain.

The best way of mounting the sulfid powder is to fix it by means of collodion or a rubber solution on a copper plate slightly roughened by an electrolytic deposit. Radiation from one surface to the other must be intercepted by means of a lead screen.—*Comptes Rendus*, March 28; *Lond Elec.*, April 15.

### Illustrated Review of Physiologic Therapeutics.

The second quarterly number of this journal, edited by Dr. S. H. Monell, announces the conditions of a prize essay competition on x-ray methods and results. Twenty-five prizes are offered. The first prize for the best essay is \$1,000; the second, \$200; the third, \$50; the fourth and fifth, each \$25, and the remaining twenty, \$10 each. Not less than three hundred essays must be entered for competition, and no author of a book on x-rays can compete. The conditions of the contest are, first, that each one must be a subscriber to the *Review* (\$6 per year). Second, two typewritten copies of the manuscript must reach the office of the *Review* at No. 19 East Sixteenth street, New York, N. Y., by September 15, 1904. Manuscripts must be unsigned and marked with a figure for identification. A duplicate of this figure, with the author's name and address, must be sent in a separate, sealed envelope. The subject may be selected and treated in whatever way the writer thinks best. The essays are not limited to any particular length. Photographs of methods will be given more weight than the "before and after" style.

The publishers of the *Review* hope that this competition will bring together a large number of the latest and best results in laboratory work on the x-ray.

The *Review* is beautifully illustrated and is filled with selected articles, most of which have appeared in other journals during the last few months. Dr. S. H. Monell contributes a paper describing the x-ray compression and focusing cylinder for accurate radiography. This is a short lead cylinder with a diaphragm, mounted in a frame which is attached to the table and carrying a tube holder. The cylinder acts as a double diaphragm to cut off all extraneous rays, and as a compressor for holding steady the part to be photographed. The tube holder allows of a measured horizontal motion of the tube, enabling stereoscopic radiographs to be taken with accuracy and ease. Numerous illustrations are given of the apparatus, and much greater clearness in the radiographs is claimed when this method is used, but no examples are given to illustrate the claim.

A BARGAIN.—One 12-inch Scheidel coil and rheostat, in perfect condition, for sale. Address H, in care of the X-RAY JOURNAL.

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DR. JOHN E. GILMAN.

# THE AMERICAN X-RAY JOURNAL

Devoted to Practical X-Ray Work and Allied Arts and Sciences.

VOL. XIV.

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No. 6

## The Rational Treatment of Malignancy.

BY H. PRESTON PRATT, M. D., CHICAGO.

Dr. Roswell Park, in an address before the surgical society in Germany, is credited in the newspapers with saying that in America cancer is making such rapid headway that there are more deaths from this disease than from tuberculosis.

If this statement is true, and we have no reason to doubt it, as it comes from a surgeon of such excellent standing, who is certainly familiar with the statistics on the subject, it behooves the medical profession to awaken, broaden out, and follow up every new channel of scientific investigation until it has discovered a method which will decrease this mortality.

Surgery pure and simple has had its sway sufficiently long for us to realize that we can no longer expect much from that source, and we are all bound to admit that it has not materially decreased the mortality, but instead has often hastened death, and consequently should be either relegated to the background to enable science to develop a more rational method, or if used at all it should be used only as an adjunct treatment. This same opinion was expressed by the celebrated Dr. Agnew, who said, "I do not remember a single case of cancer operated on by me that was cured." At the meeting of the American Electro-Therapeutic Association in September, 1902, Dr. W. J. Morton incidentally read a quotation from a private letter, refraining, of course, from

giving the name of the surgeon, who, however, is one of the distinguished operators of New York City, which is as follows: "I am an absolute pessimist regarding the curability of such cases by surgical operation, and only operate with that motive in view out of deference to current surgical opinion. I have never seen, even after the most thoro operation, a single case of scirrhus of the breast with a cancerous axillary gland cured by excision." Even Dr. Robert Rayburn, the only surviving surgeon of those who attended Garfield in his last illness, made a similar statement before the same Association meeting at Atlantic City last September. He said in substance, "Every surgeon knows or ought to know that the knife does not cure cancer; it simply opens up the channels, allowing the infection to spread more rapidly; and we should seek other methods." So long as the knife continues to be used, so long we will be kept in ignorance of a more rational treatment. According to the writer's opinion the treatment should be directed towards closing the channels and limiting the area of infection; in other words, housing off the cancer from the rest of the body. When this is accomplished the knife can be safely used to remove the septic mass, thereby materially lessening the danger of recurrence.

Another once popular treatment, which



was used more extensively by quacks than any one else and which has a good many cures to its credit, is by escharotics, the use of arsenic preparations, zinc chlorid pastes, etc. These are used extensively on superficial malignant growths and invariably leave a scar.

Another treatment which has proven itself more efficient in superficial growths is the x-ray, and still a fourth treatment which has been looked upon with favor is the galvano-cautery knife.

The fifth and sixth treatments for superficial as well as deep cancer, and which have the greatest number of cures in their favor, are commonly known as the electrolytic or the Parsons, and the kataphoric or Massey methods.

The last or seventh method of treatment which I will refer to is a modification of the fifth and sixth methods, a method which in my opinion has greater possibilities than them all. This is a combination of either the Parsons or Massey and the writer's own method.

Without going into the pathology of cancer, permit me to say that almost all pathologists have agreed that cancer is of parasitic origin.

The most rational treatment, in my opinion, is to sterilize the tissues around the growth by mild currents of electricity, driving into the tissues oxygen and chlorin. This prepares the tissues to resist the encroachment of the cancer cell. After this, follow up by the Massey treatment, driving zinc and mercury into the tissues with heavy currents, thereby cutting off the circulation and at the same time destroying the cancer cells outright. For the superficial growth arsenic or other medicaments can be driven into the tissues by the kataphoric action of the x-ray with excellent results in some cases.

The cautery knife can be used sometimes to advantage, because it partially

closes the channels of infection, or in other words checks the infection if it has not already passed beyond the point subjected to the knife. If the infection has not gone too far a method which walls off or limits its area is the ideal one; then the knife or cautery knife can be used to advantage. A chemical analysis reveals of the same elements as a non-malignant the fact that a malignant cell is composed one, which would naturally suggest to an inquiring mind that perhaps the difference could be accounted for in the same manner as in the case of the isomeric carbohydrates whose molecules are identical in composition and weight, but differ in structure. The difference is due to the rearrangement of the elements in the molecules and cells and in their relations to the adjacent molecules and cells. To bring about a change in the structure of the cell would possibly mean converting a malignant cell into a non-malignant cell. This is probably what takes place when the Parsons, Massey or x-ray methods are used. The Parsons flash method consists of placing two electrodes, one from each pole of a battery, within a short distance of each other, and turning on and off the current of from 200 to 600 ma. The duration of flash is about twenty seconds in alternation. This brings about a change in the position of the elements comprising the cell, which in turn changes the character of nutrition of the cell.

Massey's kataphoric method consists in driving zinc and mercury into the tissues, producing a marked destruction of tissue near the electrode, and at the same time sterilizing the tissues for some distance beyond. The difference between the two methods is quite marked.

The methods which I have lately adopted and which have proven so far most satisfactory are as follows:

First, in treating superficial epithelioma

I use the x-ray alone or in combination with arsenic or zinc-chlorid paste. For cosmetic effect the x-ray alone is preferable. If the superficial epithelioma refuses to yield to the above treatment the writer sterilizes the outer border by driving oxygen and chlorin by kataforesis into the tissues with a mild current.

Secondly, for deep seated growths I sterilize the outer border of the growth first with mild currents, then follow up the treatment by driving zinc and mercury into the tissues. Not only does the positive pole dehydrate the tissues, but it restricts the circulation. The heavy currents sterilize the surrounding tissues and produce a decidedly destructive local effect.

It is a well known fact that when the negative pole is applied to a stricture a mild current will disintegrate it, thereby relaxing the surrounding tissues, while a much heavier current will produce an increased source of irritation and may make matters much worse. So far we use a very mild current to drive oxygen and chlorin into the tissues so that the channels will be thoroly sterilized before the introduction of the heavier currents, thus preventing contraction of the tissues. After the borders of the growth are thoroly sterilized and the center destroyed, it is safe to go in with a knife and excise the mass.

The report of a very interesting case treated in our laboratory I will give complete and let you judge for yourself.

Mr. A., of Nebraska, who was referred to this laboratory by Dr. H., had an extended epithelioma of the lower lip. He had consulted several skin specialists as

well as surgeons. They declared that the case was inoperable. They advised him to go home and make himself as comfortable as possible. Dr. H., who treated the case, used the x-ray for about nine months. For a while it seemed to improve. Then it began to increase in size. This was the condition when we commenced treatment. The first thing done was to apply preparations of arsenic and drive it into the tissues by the use of the x-ray, which was followed up for four months, daily treatment. Then we began to inject into the body of the tumor surrounding the tissues animal extracts, and used mild currents of electricity to hasten their absorption. Then the animal extracts were injected hypodermatically into the fleshy part of the hip. This treatment was followed up for about six weeks daily. After that he was placed under an anesthetic. Zinc and mercury were driven from the positive pole into the surrounding tissues, which not only dehydrated them, but at the same time cut off the circulation and they were destroyed to a great degree. After a period of about two weeks the infiltration at the angles of the jaw and glands had entirely disappeared. Then the knife was used to excise the mass. A letter from his physician a few days ago stated that the patient has fully recovered, gained eighteen pounds, and is happy. This treatment seemed to be a long one. Experience in similar cases has taught us that the full treatment could be completed within thirty days. I am of the opinion that if all these malignant cases were properly sterilized in a like manner before the knife was used we would be able to control a large per cent of them.

## Causes and Forms of Treatment in Chronic Prostatitis.\*

BY F. A. LEUSMAN, M. D., CHICAGO.

Gibbon amused himself for twenty years, so he says, writing his inimitable history of the decline and fall of the Roman Empire. Not being a Gibbon nor having his time, means, or powers of observation, I may be forgiven if my research is less exhaustive, my personal observations deficient, acuity of discernment and purity of style absent. But when we indulge in the superb privilege of reading Gibbon or history in general, it seems to me that economies will, in a practical way, be found to be the necessary foundation-stone to sustain the weight of whatever lofty superstructure we may direct our fancy to or execute with the arts at hand. It would seem that with some attention of a practical and scientific character given to the needs of the male and female human animal, a paper like the present one could not form even a subject for that. But reason, scientific attainments, social life and economies are still in a state of evolution, and with it we have the question of prostatitis, this common but so frequently overlooked affection. Let us endeavor to find what are the causes, especially the common causes, which our daily practice with its inquiry into the habits of the patient (and sometimes of the doctor) would seem to demonstrate. There we notice that the prostate and its ills do not trouble its bearer until it has reached anatomical development and physiological needs. That means from the age of fifteen and upward until death or old age. There is no prostatitis in childhood. We further find that an individual with normal general as well as sexual habits, even if he reaches an age of eighty or more years, has no prostatic disease, no dreaded prostatic enlargement. Normal man with normal life knows no prostatic disease.

We will here exclude from study tuberculosis, syphilis, tumor, inherited constitutional diathesis, the sins of our fathers or mothers.

Well, what then leads to prostatitis? We answer, violation of the laws of nature, and, unfortunately, nature is a harsh and inexorable judge that exacts ever her dues, and yet we poor mortals never discover her intentions except by previously violating her rules; and even then nature does not speak in plain terms, but we must be content with inferences and deductions, *post hoc ergo propter hoc* conclusions. That is the layman's reasoning, and the doctor has to do the same, with the advantage, however, that some knowledge of the subject and ability to corral what we call facts gives him.

A common cause for prostatitis is masturbation. It almost seems to me that this solitary vice is the most common of all the causes. We find that almost all captive animals, if not caged up with mates, masturbate. The human male animal after puberty, if virtuous and single, behaves sexually a good deal like the caged and unmated monkey—he masturbates. The more intellectual, the saner will be his modes of eating, sleeping, working, thinking, and the more choice he will be in his associations. The more temperate he is in drinking alcoholic beverages, the less he will masturbate, but I am afraid he will masturbate some way, sometimes, unless properly mated. Now, the amount of prostatitis set up will be in direct ratio to the amount of self-abuse that he allows himself, and I do believe that if he did masturbate but once in a year, the damage done would not be enough to set up structural and functional changes, but unless he mates he will masturbate, and probably more than once a year. Mastur-

\* Read before the American Electro Medical Society at Chicago, Dec. 2, 1903.



bation never satisfies the sexual appetite. Our alcoholic friends tell us that the more one drinks the thirstier one grows. It is the same with masturbation. Sexual longings become almost uncontrollable with a man suffering from a masturbation prostatitis.

A prominent lawyer consulted me once for relief of symptoms due, as the examination revealed, to a prostatitis. For about a year he had visited an estimable and religious young lady to whom he was much attached and who appeared to reciprocate his affections. Almost daily he called on his lady love, and in a short time they became so familiar that no privileges was denied except that of sexual intercourse. The lover still kept coming, fascinated and hopeful of gaining his point. But the fortress resisted successfully every art of ingenuity and passion. Finally my patient had to desist, with the prostate in a fearful state of subacute inflammation. He is now married, but his prostate has remained a *locus minoris resistentiae*.

Many young men derive comfort from the erroneous belief that masturbation means the use of the hands, but that titillation brought on otherwise, as with his sweetheart on his lap, etc., is not harmful, till otherwise taught by symptoms referable to the prostate.

Since our study is more directly engaged with chronic prostatitis and its exacerbations, we can afford to but cursorily allude to causes such as trauma, the presence of a calculus or other foreign body in the posterior urethra. Excessive use of drugs, such as cantharides, phosphorus, etc., irritating injections, errors of diet, horseback and bicycle riding, may lead to prostatitis; as a rule, however, only to exacerbations of the chronic type. Coitus interruptus is another common cause. It is a question how often economy

on the part of the husband, or fear of offspring and its labors, trials and privations on the part of the wife, is a motive that leads to this pernicious habit that fancies it can cheat nature.

The important role, however, as an etiological factor, is played by gonorrhea. Zuckerkandl says: "Inflammations of the prostate are, with the exception of the gonorrheal ones, not frequent; as primary idiopathic processes they are the greatest of rarities. There is evidence lacking that trauma or cold act as causes."

Thompson, Guyon and Socin doubt that a healthy prostate may be injured by riding on horse or bicycle, but of course a sick prostate may sustain exacerbations by such means.

We must stop to consider for a moment the relation of infection to congestion and inflammation. It does appear that a masturbating and withdrawal prostatitis can exist for quite a time without infection, but of course must be looked upon as factors favoring secondary infection. Trauma in particular is harmful not so much because of the harm that it does in itself, as because it favors and frequently necessitates secondary infection; hence the frequency with which prostatitis follows after non-surgical (that is, dirty) catheterization or sounding.

Excess in venere is also looked upon as a cause. If so, it proves a rare one; other factors more easily explaining the etiology. Disease in the neighboring organs, while acting as predisposing, contributing or exacerbating factors can hardly be arraigned as causes, such as, for instance, hemorrhoids, fistula, fissure, constipation, varicocele, congenital phimosis, narrow meatus, urethral stricture, etc.

Prostatitis in the wake of typhoid fever, etc., has been observed.

The causes, then, of prostatitis would seem to be direct and metastatic infection,

most commonly gonorrheal, masturbation and coitus reservatus.

Finger, Furbringer and others have microscopically studied the pathological anatomy, and found it to show just what our knowledge of chronic inflammation applied to the prostate gland would lead us to expect. The changes are in the beginning catarrhal, that is superficial, being mainly a desquamative process. On the continuation of the cause this condition is carried to the lumen of the glands, and from there soon follows a periglandular infiltration, leading to changes of the tubules and their epithelium. Dilatations, occlusions, and various forms of degeneration; the parenchymatous tissue undergoing finally cicatricial tissue metamorphosis, with or without multiple abscess formation and calcification.

A consideration of this pathology with its extension to the internal vesicular sphincter will readily explain the somewhat varied symptomatology, the difference from normal in the size, form and tenderness of the gland. We can thus understand why one set of standard authors proclaim there is no prostatitis without prostaticorrhea, while the other equally authoritative set assert that prostaticorrhea may be a symptom, but is as often absent as present. In fact, a prostatitis may exist for a long time, unbeknown to the bearer. It would seem that the activity, extent and character of the inflammatory process as it affects the glands and involuntary and voluntary muscle fibers of the prostate would serve to furnish a satisfactory explanation. The diagnosis must exclude syphilis, tuberculosis, tumor, and hypertrophy. If the catheter reveals residual urine, the case is one of hypertrophy, from a clinical point of view, and must be treated as such. Bimanual palpation determines the presence of prostatitis. The rectal finger will dis-

close changes from the normal as to form, movability, softness or hardness, amount of prostatic expression, and tenderness. Posner proposes to pass two ounces of urine in a glass and a like quantity in a second glass, the rest of the urine still being retained in the bladder. Then massage and express the prostate, and let the patient pass the last portion of the urine. If chronic prostatitis is present, this portion of the urine will be found cloudy. The microscope will show pus corpuscles, shreds, epithelium in excess, and probably micro-organisms. Gonococci have been found in many cases.

The diagnosis further considers the co-existence of disease of the associated sexual and urinary organs, as the seminal vesicles and bladder, ureter and kidney, and disease of neighboring organs, as the rectum. I have found the examining cystoscope an extremely valuable adjunct in showing the presence or absence of cystitis, vesical ulcers, ureteral pathology and calculus. It seems to me at the present state of our knowledge an injustice to the patient not to have recourse to this valuable and simple diagnostic resource.

The diagnosis further interests itself with a thorough general examination of the body and mind of the patient, and his habits.

Guyon says prostatitis is difficult but not impossible of cure. I agree with this dictum. Both patient and doctor must understand that it will take months, sometimes years, to furnish a clinical cure.

#### TREATMENT.

Success will largely depend on the length of time the disease has been in existence, its cause or causes, and structural changes; but no less on the choice of method employed, and the ingenuity and versatility displayed by the doctor in meeting the ever-changing indications. As a preliminary, tho by no means always

necessary, measure it may be well to remove, if present, phimosis, varicocele, stricture, hemorrhoids, congenitally narrow meatus, prostatic calculus, and other surgical conditions.

Purely symptomatic treatment is harmful and irrational. The choice of methods will to a great degree depend on whether the local changes are catarrhal, i. e., superficial, or whether there are periglandular infiltrations with destruction of the affected gland tubes, or many cystic dilatations. Prepare your patient for the fact that constant relapses will occur, an undesirable but natural and regular occurrence. There is to be a long fight for health, with reasonable grounds for hope of success, provided perseverance, good judgment, skill and experience manage the case.

Every factor tending to cause congestion of the prostate is to be avoided, as the ingestion of alcoholics or irritating (excess of meat and condiments) or too rich or too much food. The patient's life must be regulated along the well-known and daily neglected laws of hygiene. Even these laws have to be individualized, and it may be that the sound judgment and management of the attendant will be able to accomplish success by means of more than one method. Now rest, now exercise, now home or hospital treatment. then again ambulatory office treatment will seem preferable. Travel, mountain and seaside resorts and sanatoria effect cures when all else fails. The problem of treatment here as elsewhere depends upon the socio-economic condition of the patient, his intelligence and culture, his character and temperament, his age and constitutional diathesis. It is the richness of the field that accounts for the prolific crop of forms of treatment. The problem with us always is to choose what suits best the case in hand. We must be as quick at

changing our front as our patient's condition changes his. With a due appreciation of all the facts, we review cursorily our more common resources at hand, so far as local treatment is concerned, whenever that becomes necessary. We recollect right here that all forms of local treatment are unnecessary in some cases, and in some cases are useful only at varying intervals, while in many some form of local treatment will be absolutely indispensable if we wish to conserve the best interests of our patient. Space absolutely forbids more than a partial enumeration of these local means used; a critical comparison of these methods would be impossible, since opinion is divided, and the subject does not lend itself to the ordinary methods employed for scientific demonstration. It is probable that time will be the arbiter. Cupped sounds for the application of salves may have proven beneficial, no doubt, in the past, but are now almost obsolete. On the whole, it appears that salves or ointments are now but rarely used. They are more difficult to sterilize, more difficult to localize, of too superficial action in concentration similar to solutions, and the tubes and syringes used for their employment are difficult and time-taking to clean, besides they do not seem to possess a single feature that solutions do not possess in an equal or a far superior degree.

Prostatic dilators, with or without irrigation attachments, are, it seems to me, of more than doubtful utility. They are painful to use, cause more reaction than necessary or useful, and expression of the prostate is infinitely more efficiently done by massage. The urethral sound of the larger caliber that the urethra will admit, used at intervals, appears almost always to be grateful to the patient in relieving one or more of the common prostatic symptoms. The prostatic endoscope and the



local application thru its aperture of silver nitrate and mercury bichlorid solutions has proven but moderately useful in the writer's hands. Socin's assistant claims very beneficial results, especially from bichlorid of mercury applied this way once in five to seven days. I have abandoned in most cases the use of the prostatoscope, and favor a Guyon catheter instilling syringe. I have also abandoned the Ultzmaun silver catheter syringe, the pattern after which Guyon made his syringe, because the pressure and stiffness of the hard and unyielding silver tube were found to be more annoying to the patient than the soft, yielding gum catheter of Guyon; besides you always know just where you are with the latter.

The Guyon bulb catheter is withdrawn as far as the posterior aspect of the compressor urethra muscle; the last few drops of the urine allowed to escape, and the instillation is then made. Nitrate of silver in rather weak solution, 1/1000 to 1/500; mercury bichloride solution, 1/5000, have proven useful. My patients have apparently almost always liked argyrol solution, 15 per cent, best of all. Argyrol is decidedly less irritating than protargol. Argyrol and bichlorid, single or combined, are my favorites, but I do employ occasionally picrotol, 1/20 per cent; copper citrate, saturated solution; ichthyol, 1 to 10 per cent. Collargol, 1/5 to 2 per cent, has also been found useful. Sulphate of copper I have always found to be too irritating, even in weak solutions, and have discarded its use entirely. All vegetable agents like ergot, hamamelis, tannic acid, hydrastis, kino, krameria, depend on their superficial astringent effect principally, and are not antiseptic or alterative. I have therefore given them no trial.

Iodoform I have not used because both my patients as well as myself objected to the odor; besides I have never known

an instance in my general surgical practice where it was not easy to displace the iodoform that has led the big and the little doctor around long enough by the nose. I consider it irrational to use insoluble substances, like bismuth, subnitrate and lead. It has been my practice to always instill a Guyon syringe-ful; in that way the prostatic urethra is somewhat distended, and the medication made as extensive as desirable, with a little useful overflow over the internal vesical sphincter. And, again, the ever-present drop of urine is less liable to readily decompose ninety drops of solution than one to ten drops.

When employing the bulbous Guyon catheter, use the smallest bulb that will be arrested by the posterior face of the compressor urethra muscle on withdrawal. When introducing the bulbous catheter it frequently becomes arrested by the anterior face of the compressor urethra. One of my patients, when directed to divert his thoughts, to relax this muscle, told me he could do that now easily and efficiently by thinking how to find money to pay numerous bills with.

Prostatitis, when long-standing, sets up a motor neurosis of the internal and external vesical sphincter, a so-called cystospasm, which eventually leads to contracture of the neck of the bladder, and residual urine. I have observed that Guyon's instillations have cured cases of the latter kind.

Competing in usefulness with Guyon's instillations, if not superior, is massage of the prostate per finger in rectum. A treatise might be written giving directions. The principle is, express the prostate patiently one to six times a week. The process, however, must not be severe enough at any time to aggravate the symptoms. While massaging, the pressure must be steady and not intermittent; the

movements slow, covering all of the surface of the organ. Periprosthetic adhesions frequently give way to massage extended over a long period of time.

Very useful also is galvanism. Placing the positive pole inside the lumen of the prostatic urethra, use three to five milliamperes once or twice a week, five minutes for a seance, observing carefully the results. Galvanism has seemed of especial benefit in atonic conditions. I frequently associate or alternate the sound, Guyon's instillations, prostatic massage and galvanism, almost to the exclusion of other local measures, with the exception of an antipyrin 10-grain suppository, which patients afflicted with exacerbations of pain use at such times, with some relief.

The mechanical vibrator, while of benefit sometimes, on the surface of the body, I have found of little or no benefit when employed intrarectally; in fact, in some instances it has aggravated the symptoms.

With the x-ray I have no experience whatsoever, but believe from what I read in the literature that it may prove of value in some cases.

Von Hogge has also used an apparatus in the form of a finger-like instrument, on whose volar side is a platinum plate, isolated as a negative pole; introduced into the rectum. The positive pole is on the surface of the body. It is simply mechanical massage plus galvanism.

It is unfortunately true that no mechanical instrument in the nature of things will ever be able to take the place of the sentient and intelligent finger. I employ solutions and suppositories, otherwise, as mentioned, very rarely, for I have seen no benefit follow their use. I object to the home use of the psychrophore, as liable to lead to infection. It is of no benefit otherwise. Very frequently, however, I recommend for home

use the Artzberger cooling or heating rectal apparatus. It is important, however, to keep the bowels, especially the rectum, empty, by means of rectal and colonic douching, if necessary. Suitable aperients may be used, and above all, the establishment of proper ways of eating, drinking, sleeping, work, exercise, rest, ventilation and bathing. It is wonderful what these regulations will do for our patients.

I have performed bilateral vasectomy, with some anclioration, in a case of a widower over fifty years old. I have never proposed or performed a Bottini galvanocantery incision, for I do not see how in a case of prostatitis not complicated by residual urine a single or even multiple endoprosthetic cauterization can do much, if any, good, and it may and frequently does do harm.

Perineal prostatotomy does not appeal to my judgment. I have not even seen claims of a cure or improvement from that procedure.

Castration might do some good, but its relatively high mortality rate has made it an obsolete operation for this purpose.

As to sexual intercourse among the married, I will say that I advise absolute continence when patients feel in any way worse after the act; otherwise I recommend an economical use of this function at rare intervals. The sensations and experiences of the patient in the main are the guide. During periods of exacerbation I have observed decided benefit from the painting of the perineum with strong tincture of iodine. This procedure compels the patient *volens* to avoid bringing to bear any pressure on the prostate. It is well to recall that under physiological conditions the greatest enemies of the *libido sexualis* are hard mental and hard physical labor.

Faradic treatment, a molecular mas-

sage, except in old and atonic cases, I have found to be harmful if locally applied. It is too rough a form of treatment. If the disease progresses in spite of all treatment, or no treatment, and the patient is seen to gradually lose ground more and more, getting ready for consumption, as it were, then, and long before that time, it will be proper to propose perineal prostatectomy, which, if done according to the classical description given by Murphy in one of the late editions of the Journal of the American Medical Association, will furnish relief and rid the patient of an organ diseased beyond cure. Of course, the *vis coeundi* and *vix generandi* are lost with this operation, but those patients have lost both powers before,

so on that score no real additional injury is inflicted.

As to the internal drug treatment, I have to say but little, since that must be largely symptomatic, sedative, stimulating, reconstructive. Maltine, the hypophosphites with and without strychnia, animal and vegetable digestants, vegetable aperients, saline cathartics, brom-soda, soda, camphor monobromid, hyoseyamus, saw-palmetto, urotropin, sodium bicarbonate, acetanilid, according to indications, I have used, with relief to my patients.

I regret to have not previously referred to the static machine, which in many cases, especially of the neurasthenic type, is a *palliativum* of the very first order.

## International Electrical Congress of St. Louis.

12-17 September, 1904.

Under the auspices of the Louisiana Purchase Exposition an International Electrical Congress will be held in St. Louis during the week 12th to 17th September.

The congress will be divided into two parts, namely:

(1) A Chamber of Government Delegates appointed by the various governments of the world, invitations to which were issued at the beginning of the year from the United States Government. The transactions of the Chamber of Delegates will relate to matters affecting international questions of electrical units, standards, and the like.

(2) The congress at large, divided into eight sections, as follows:

General Theory—Section A, Mathematical, Experimental.

Applications—Section B, General Applications; Section C, Electrochemistry;

Section D, Electric Power Transmission; Section E, Electric Light and Distribution; Section F, Electric Transportation; Section G, Electric Communication; Section H, Electrotherapeutics.

Our readers will be interested in Section H—the Electrotherapeutic Section.

The president of the Committee of Organization is Professor Elihu Thomson, of Lynn, Mass. The vice-presidents are B. J. Arnold, Professor W. E. Goldsborough, Professor H. S. Carhart, C. F. Scott, Dr. S. W. Stratton.

The chairman of Section H is Dr. W. J. Morton, New York City, and the secretary is Mr. W. J. Jenks, of New York City.

Three hundred and forty-three official invitations were issued some months ago to well-known workers in electricity, inviting papers for the congress; 168 of these invitations were issued to persons



residing in countries outside of North America. As a result of these invitations 105 American and 59 foreign specially-prepared papers are promised to the congress. Of these five foreign and fifteen American papers are in Section II, as follows:

Section II—Electrotherapeutics. Chairman, Dr. W. J. Morton; secretary, Mr. W. J. Jenks.

Prof. M. Benedict—"Radiology in the Pathology of the Brain."

Dr. J. Bergonie.

M. le Docteur G. O'Farrill—"Some Improvements in Generator Apparatus of High-Frequency Currents."

Prof. S. Schatzky—"The Ionic Theory as Biological Basis for the Therapeutic Action of Electricity"; "Experimental Researches on the Treatment of Tuberculosis by Constant Current."

Dr. J. Riviere—"Physico Therapy of Neurasthenia."

Dr. Carl Beck—"Recent Advances in Roentgen-Ray Science."

Dr. Russell H. Boggs—"Diagnosis of Calculi by X-Rays."

Dr. G. G. Burdick—"Radiations in Therapeutics."

Dr. Margaret A. Cleaves—"The Nature of the Changes Established in Living Tissue by the Action of Oxidizable Metals at the Anode."

Dr. Charles R. Dickson—"Some Observations Upon the Treatment of Lupus Vulgaris by Phototherapy, Radiotherapy, and Otherwise."

Dr. Emil H. Grubbe—"X-Rays and Radio-Active Substances as Therapeutic Agents."

Dr. T. Proctor Hall—"The Principles of Electro-Therapeutics."

Dr. J. H. Kellogg—"Electro-Therapeutics."

Prof. Jaques Loeb—"The Control of Life Phenomena by Electrolytes."

Dr. John Williams Langley—"The Purification of Water for Drinking by Electricity."

Dr. G. Betton Massey—"The Cathodic Diffusion of Metallic Ions in the Destructive Sterilization of Cancer and Tuberculous Deposits."

Dr. W. J. Morton—"Artificial Fluorescence of the Human Organism as a Means of Treating Disease."

Dr. C. S. Neiswanger—"Static Electricity in Chronic Nephritis."

Dr. Clarence E. Skinner—"A Large Fibro-Sarcoma Treated by X-Radiance."

Dr. Wm. Benham Snow—"Static Electricity in Therapeutics."

Up to the 30th of June, 1887, adhesions to the congress had been received, of which about 1,300 have paid their subscriptions of \$5 each. Of these, 291 are from countries outside of North America. The following societies will co-operate with the congress at St. Louis, by holding simultaneous conventions and joint sessions:

The American Institute of Electrical Engineers.

The American Electrochemical Society.

The American Physical Society.

The American Electrotherapeutic Association.

The Association of Municipal Electricians.

The following societies will co-operate with the congress by appointing delegates:

The National Electric Light Association.

The Association of Edison Illuminating Companies.

The Societe Internationale des Electriciens.

The Schweizerischer Electrotechnischer Verein.

It is expected that various other European societies will also co-operate.

Fourteen thousand six hundred invitations have been issued to persons interested in electricity all over the world, inviting them to join the congress. It is expected that the transactions of the congress will attain two or three large volumes. Persons interested in electricity

and who desire to join the congress should apply to the general secretary, Dr. A. E. Kennelly, Harvard University, Cambridge, Mass.

Each member of the congress is entitled to receive one set of the transactions. It is intended to issue the transactions of the congress, when printed, to libraries and non-members for \$10 per set.

### American Electro-Therapeutic Association.

The fourteenth annual meeting of the American Electro-Therapeutic Association will be held at the Inside Inn, St. Louis, Mo., September 13, 14, 15 and 16, 1904. The scientific sessions will be held only in the mornings, leaving the afternoons free in which to visit the attractions of the fair. It is believed that a large proportion of the members of the association will be present this year, as the World's Fair offers many attractions in itself; and in addition to the convention of our association, there will also be held in St. Louis, from the 8th to the 17th of September, the annual convention of the American Roentgen Ray Society and the convention of the International Electrical Congress. These events will make St. Louis a point of great interest to us at the time of our convention there.

As the convention is to be held at the Inside Inn, it is very desirable that all the members should have their quarters in this hostelry; hence if you have not already engaged your rooms, it would be wise for you to write and do so at once on the reservation blank contained in the descriptive pamphlet of the Inn which I sent you two months ago.

The following amendments to the Constitution and By-Laws, notice of which was given at the 1903 meeting, will be voted upon at this meeting, namely, Sec-

tions 9, 10 and 11 of the Constitution to be so amended that they will read as follows:

"Every applicant for membership, whether a Fellow, Life Fellow, Honorary Fellow, or Associate Fellow, shall be endorsed by two Fellows in good standing, and be presented to the Executive Council through the Secretary, the properly signed application blank to be accompanied by the admission fee of five dollars, which shall also constitute, in the event of election, the annual dues of such applicant for the year during which he is elected. If he is not elected the five dollars shall be returned to him with notice of rejection. The Executive Council shall make due inquiry concerning the professional attainments and standing of the applicant, and if satisfied as to his eligibility, shall instruct the Secretary to notify each Fellow that the election to fellowship of such applicant is recommended, and that unless good and sufficient reasons for rejection are communicated to the Secretary within a stated time (which shall be not less than two weeks), such applicant shall be considered duly and properly elected. A postal card directed to each Fellow at his address last known to the Secretary shall be considered sufficient notification of such impending election.

If no such communication is received

within the specified time, the applicant shall be considered as duly elected as Fellow of this Association, and a duly executed certificate of membership forwarded to him forthwith; if such a communication is received, election of the applicant shall be deferred until the annual meeting following, notice that such applicant will be voted upon being sent to each Fellow at least one month before the date of such meeting. A two-thirds vote in the affirmative of all the Fellows present shall be necessary to elect at such meeting; fifteen Fellows at least being in attendance.

10. The signature of an applicant upon his membership application shall, in case he is elected, be considered as equivalent to his signature to the Constitution and By-Laws, and shall be binding upon him as concerns his submission to the regulations contained in said Constitution and By-Laws.

11. The function of nominating Honorary Fellows shall be vested in the Executive Council.

Section 57 of the By-Laws to be omitted entirely, and by-law 58 to be so amended as to read, "Each Fellow shall pay annually in advance to the Secretary the sum of five dollars, which shall constitute his annual dues."

The preliminary program to date, subject to amplification and revision, appears below:

"Some Observations on the Medical Uses of the Constant Current."—Daniel Roberts Brower, of Chicago, Ill.

"The Therapeutic Application of the Continuous Current."—Truman Abel Pease, of Norwood, N. Y.

"Exhibition of a New Current Controller and Discussion of the Methods of Therapeutic Control of Street Main Cur-

rents."—George Betton Massey, of Philadelphia, Pa.

"The Cataphoric Treatment of Cancer."—Amedee Granger, of New Orleans, La.

"Clinical Reports of Some Interesting Cases Treated by Electricity."—Samuel Fairweather Wilson, of Montreal, Canada.

"Clinical and Experimental Effects of Electrical Currents of High Potential and Frequency."—John Holcomb Burch, of Baldwinsville, N. Y.

"Therapeutic Action of High Frequency Currents."—Walter Henry White, of Boston, Mass.

"Electro-Therapy of the Psychic and Sympathetic Neurone Centers."—Charles H. Hughes, of St. Louis, Mo.

"The Physiotherapy of Neurasthenia."—T. Riviere, of Paris, France.

"The Value of the Roentgen Ray in the Diagnosis of Fractures."—Mihran Krikor Kassabian, of Philadelphia, Pa.

"Diagnosis of Calculi."—Russell Herbert Boggs, of Pittsburg, Pa.

"Further Researches in the Treatment of Tuberculosis."—Jefferson Demetrius Gibson, of Denver, Colo.

"A Case of Hyper-Idrosis of the Axillæ Cured by the X-Ray."—George H. Stover, of Denver, Colo.

"Violet Light Baths; their Physiological and Therapeutic Effects."—Ernest Albert-Weil, of Paris, France.

"The Use of the Ultra Violet Light in Therapeutics."—Albert Eugene Stern, of Indianapolis, Ind.

"Locomotor Ataxia Successfully Treated with Ultra Violet Rays."—Joseph Monroe Liebermann, of New York, N. Y.

"Some Aspects of Phototherapy."—Charles Rea Dickson, of Toronto, Canada.

"Photo-Therapy in Chronic Diseases."—John Harvey Kellogg, of Battle Creek, Mich.



"The Importance of Associating Other Physical Measures with Electricity in Therapeutics."—William Benham Snow, of New York, N. Y.

The members of the Committee on Arrangements are C. H. Hughes, M. D., chairman; A. V. L. Brokaw, M. D.; John Young Brown, M. D.; C. G. Chaddock, M. D.; Pinekney French, M. D.; Marc Ray Hughes, M. D.; B. M. Hypes, M. D.; L. H. Laidley, M. D., and W. G. Moore, M. D., all of St.

Louis. These gentlemen have arranged social features and amusements for the ladies who will accompany members, which will appear in the completed programs which will be distributed at St. Louis. Any further information can be obtained by writing to the secretary or the chairman of the Committee on Arrangements.

CLARENCE EDWARD SKINNER,

Secretary,

New Haven, Conn.

## Fifteenth International Congress of Medicine, Lisbon, April 1906.

"We have received the first number of the Journal of the Fifteenth International Congress of Medicine, that will take place in Lisbon on the 19th to 26th of April, 1906. This number contains the statute of the Congress, the organization of the sections and of the national committees of the different nations. One must remark in the statute the second article, that only admits in the Congress, beyond the doctors, the scientific men presented by the National or Portuguese committees.

The contribution is of 25 francs or 20 marks or one pound sterling.

The work of the Congress is distributed in seventeen sections:

1. Anatomy (descriptive and compared anatomy, anthropology, embryology, histology).

2. Physiology.

3. General pathology, bacteriology and pathological anatomy.

4. Therapy and pharmacology.

5. Medicine.

6. Pediatrics.

7. Neurology, psychiatry and criminal anthropology.

8. Dermatology and syphilography.

9. Surgery.

10. Medicine and surgery of the urinary organs.

11. Ophthalmology.

12. Laryngology, rhinology and stomatology.

13. Obstetrics and gynecology.

14. Hygiene and epidemiology.

15. Military medicine.

16. Legal medicine.

17. Colonial and naval medicine.

The executive committee of the Congress has the intention to print, before the reunion, all the official reports; it is necessary that they shall be given before the 30th of September, 1905, to the General Secretary. For the free communications it is necessary that they should be given before the 31st of December, 1905, if the authors want that the conclusions should be printed before the opening of the Congress.

The official language is the French. In the general assemblies, as in the sections, the English, German and French may be used. We see that the committee of the Congress has excluded the Portuguese from the languages permitted; this has only

been done with the intention of diminishing the number of languages spoken; there can be no jealousy when the legislator begins by sacrificing himself.

The president of the committee of organization is the doctor M. da Costa Alemão; the general secretary is the doctor Miguel Bombarda; all the adhesions must be addressed to this doctor (Hospital de Rilhafolles, Lisbon.)”

#### Electrical Action in Plants and Animals.

Some of the results of the latest investigations of electrical phenomena in plants and animals are given in an article by Dr. W. Biedermann in the *Ergebnisse der Physiologie* (Wiesbaden).

Nowhere else in organic nature is there an example of the direct generation of mechanical and electrical energy on a large scale, of corresponding adaptation of structure and change of function, similar to that found in the so-called electric fishes, which have the power of discharging electricity at will as a means of defense.

A number of fishes have this power to a certain degree, but the electric organ is most perfectly developed in the South American eel (*Gymnotus*), in which there is a pair of electric organs lying on the ventral side of the tail; in the electric sheath-fish (*Malapterurus*), in which the electric battery ensheaths the body; and in the fish known as the “torpedo,” which has electric organs on each side of the head.

#### STRUCTURE OF THE “ELECTRIC” ORGANS.

The organs consist of columns of living tissue that originate as muscle but lose all resemblance to it in the course of development and take the form of thin plates, a fraction of a millimeter thick, placed one above another. The organ has a very large nerve that sends a branch to

each plate, and this branch subdivides, inside the electric plate, into fine threads, forming a delicate network connected with innumerable microscopic electric rods. The active electro-motor principle is supposed to lie in this delicate terminal network, with its electric rods, and the degree of electric power is directly correlated with the degree of development of this structure. It is a noteworthy fact that the blood supply of the electric organ is very meager as compared with the blood supply of the muscles. In the ray fishes the blood vessels never penetrate the plates that compose the organ, but lie between them.

Observations of the action of the electric current were made by means of a telephone placed in connection with the fish and provided with a device attached to the vibrating disc, by means of which any electrical stimulus conveyed to it would be registered by a line drawn on paper. It was found that often there is an electric discharge from the fish while swimming, without any defensive purpose. On account of the manner of swimming, the positive pole of the apparatus was sometimes stimulated, and sometimes the negative pole, and it was found that the quality of the sounds produced through the telephone varied according to the pole stimulated, and may be either weak and dull or sharp and crackling. The electric organs on both sides of the body always discharge simultaneously, like one organ. There is no voluntary variation in the strength of the discharge, but the shock may be made more intense by the cumulative effect of more rapid discharge of the electric organ. A single stimulation of the organ in the electric sheath-fish will produce a whole series of discharges a fraction of a second apart.

The writer distinguishes *weak* and *strong* electric fishes. In the former the organ lies deeper in the tissues of the body and lacks the finer development of nervous structure found in the latter.

#### "ELECTRICAL" PLANTS.

There are certain noteworthy observations on manifestations of electricity in plants which promise to be of great interest from the theoretical point of view. There are probably always electro-motor activities in the different parts of plants, which, it is reasonable to assume, are due to chemical differences in the different layers of cells, and they have been observed, not only as responses to mechanical stimulation, but as accompanying manifestations in the assimilation of carbon dioxid in the regular process of plant nutrition.

Certain plants, among them iris, nicotine, begonia and nasturtium, are more favorable than others for these experiments. If one of them be placed in connection with a galvanometer by means of electrodes attached to leaves on different sides, and one side of the plant be exposed to sunlight while the other side is kept shaded, then within from three to ten seconds after exposure to sunlight there will be a flow of electricity from the lighted to the shaded parts and a potential difference of .005 to .02 volt. This continues for about five minutes, when the magnet begins to swing back and shows an opposite current of consid-

erable magnitude. The manifestations are similar to those of tetanized nerve.

The electric current of green leaves is least in diffuse daylight, greater in refracted light and most in direct sunlight, and it is further affected by the temperature, 20° C. being the optimum for iris. Cooking the leaves destroys their electric activity, and the electric manifestations are not found in plants that do not have green leaves. This was considered as proof that the generation of electricity accompanies the assimilation of carbon dioxid.

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"The creation of a new species of sea life by the use of salt solutions and crossing two varieties has been accomplished by Dr. Jacques Loeb, the physiologist," says a news dispatch to the New York *Herald* (February 26). "The news of this new application of salt solutions has come in an article published by Dr. Loeb in *Pfluger's Archiv*. \* \* \* The crossing of the sea-urchin and the starfish is Dr. Loeb's recent achievement. Starfish and sea-urchins live in the ocean under the same conditions, but scientists have found that in the natural sea water the two do not cross, as do many species of animals. Dr. Loeb used an alkaline solution containing the salts of sea water and sodium hydrate. The result was a new child of the sea, neither sea-urchin nor starfish, but combining the qualities of both. Dr. Loeb has repeated the experiment more than once.—*Literary Digest*.



## Effects of Different Lights Upon the Eye.\*

BY D. W. WEAVER, M. D., GREENSBURG, IND.

Vision is the production of sensation upon the retina from which it is conveyed to the brain centers, where the impressions are formed. We speak of, or associate light with, these sensations upon the retina; but it is not essential in their production. A blow upon the eye in utter darkness will produce a sensation upon the retina that gives the impression in the visual centers of a flash of light. But in this paper we want to consider only the sensations produced upon the eye by light.

Nature provides us with plenty of good, wholesome daylight from the dawn of day until night overtakes us again, and besides this man provides himself with more light, lengthens the day by his own illuminants. The illuminant may be electricity, acetylene, natural or artificial gas, petroleum oil, tallow candle or pine-knot, as he may choose.

The light rays, from whatever source, penetrate the eye—the cornea, lens, aqueous and vitreous humors and the eight transparent layers of the retina without producing any sensation of vision. But as they fall upon the rods and cones with their pigmented epithelial covering, the visual sensations are produced.

The pigment in this layer of the retina is spoken of as “visual purple.” Upon it the images are formed through a bio-chemic process. This “visual purple,” as the sensitive photographic plate, decomposes or exhausts its image-producing properties upon exposure to light, but different from the photographic plate in that, under normal conditions, it is reproduced as fast as exhaustion takes place.

The retina must be dark for its reproduction.

Some writers claim that there are different pigments, and that they are affected by different lights, i. e., the pigment that is affected the most by yellow or orange rays, is but little affected by the violet or ultra-violet rays, and the one affected by the violet is but little affected by the orange, and so on. It is the arresting of the biological reproducing process of these pigments that causes color-blindness and amblyopia. Other factors than the over-use of the eyes are often responsible for this—such as an excessive indulgence in alcohol and tobacco, and syphilis.

I believe that there are very few cases of acquired color-blindness that have not as their predisposing cause alcohol, tobacco or syphilis, and as exciting cause prolonged eye strain under artificial light. Though I have no statistics to back me, I believe that an over-use of the eyes under an incandescent electric or gas illumination will produce color-blindness more than under any other light. This is on account of the large proportion of violet and ultra-violet in these lights.

The violet and ultra-violet rays possess an actinic or chemical property. It is these actinic rays that are irritating to the visual layer of the retina. For this reason the light with a small proportion of these rays is the light that least of all tires the eyes.

The different worth of the various lights can be best illustrated by a prismatic analysis. We find by this analysis that the sunlight consists of 97.3 per cent orange, yellow and green rays to the 2.7 per cent violet; daylight, 13 per cent vio-

\*Read before the Indiana Institute of Homeopathy, 1903, and published in the *North American Journal of Homeopathy*, May, 1904.

let; incandescent electric light, 28.9 per cent; gaslight, 28.9 per cent; petroleum light, 24.6 per cent; voltaic arc light, 3.9 per cent. This shows that the sunlight contains the least of these irritating violet rays in proportion to the orange, yellow and green (which are the most comfortable to the eyes). Second in the list comes the arc light, which comes nearer possessing the same quality as sunlight of all our artificial lights. Also that the petroleum lamplight contains less of these irritating rays than the incandescent gaslight.

This table is by Meyer, and as he does not give the spectrum of the candle or acetylene (pine-knot), I am unable to give the percentage of violet they contain.

Meyer also claims that the violet rays control the action of the pupil, and that the pupil will only admit (under normal conditions) a certain amount of violet rays. He says that this accounts for the lack of clearness of objects on what is called a "gray day," because on such days the per cent of violet is greater, and for this reason the pupil smaller, in proportion to what it is on a clear, bright, sunny day.

Under the quality of light I might also call your attention to the fact that some lights possess more heat than others, and heat rays are injurious to the eyes. An excess of violet, ultra-violet or heat rays (red) can produce any of the simple inflammatory diseases of the eye or its appendages, and in those diseases that have deeper underlying causes, light poor in quality is a potent factor for their aggravation.

Regarding the quantity of light, but little need be said. We need sufficient light whatever we do; that's a fact no one cares to dispute. Without enough of

light it is an utter impossibility to get a clear image formed upon the retina. It is understood that we need less illumination for ordinary seeing than we do for close work, as reading, because we do not care whether or not the reflection upon the retina is clear. Even in this case the illuminating of rooms for general purposes should be clear thruout to be easy and restful to the eyes. There is practically very little danger of over-illuminating (under the present stage of artificial illuminating), providing the light is diffused and evenly distributed. The danger is of under-illuminating for close work, or, if this is remedied, of producing a glaring, poorly distributed illumination.

Steadiness of light must be considered. Light, to be non-injurious to the eyes, must be steady. A flickering light, as well as the dazzling light of the "moving pictures" is tiresome to the ciliary muscles and, at the same time will produce a congested retina.

As to the position, light should fall upon the book, while reading, at right angle or nearly so; that means that it should be falling over the left shoulder. The effect of a light placed in front, even if shaded, produces a glare and heat, and as such is injurious.

#### DISTRIBUTION OF LIGHT.

An even distribution of light is necessary for the comfort of the eyes. I might give as an example of such a light the diffused sunlight. In the illuminating of rooms the light is more restful to the eyes if the room is illuminated evenly thruout. And for reading it is more essential that the light is evenly distributed over the page to be read than it is for an even distribution in a drawing room. Let, for instance, light be clear upon one-half of a page and upon the other half be

shaded and see what the result will be. The eye, following line after line across the page, from light to shadow, and again to light, and so on, for but a very short time will tire. The ciliary muscles will be overworked in trying to regulate the light thrown upon the retina.

There are other factors that might be considered in a paper of this kind, but time will not permit.

Finally, the best illumination for the eyes is the diffused sunlight. It is the richest light in yellow, orange and green

rays, is evenly distributed, is steady, is not glaring and can be had of sufficient quantity.

Man has devised innumerable kinds of shades with which to overcome the objections to the artificial lights. He has succeeded admirably well, yet there is a vast fortune awaiting the inventor of a light of the composition of diffused sunlight.

I acknowledge the free use of the paper, "Artificial Lights," by Dr. F. Park Lewis, of Buffalo, N. Y.

## Psycho-Therapy.

BY HENRY W. ROBY, M. D., TOPEKA, KAS.

I wonder how many of your readers know that there is a new wave of enthusiasm going over the country and the world as well in the matter of therapeutics, and that psycho-therapeutics is to be the cult of the near future? Many attempts have been made to graft onto medical practice what long ago was variously called exorcism, magnetism, mesmerism, clairvoyance, electro-biology, odylic force, impouilevablia, braidism, hypnotism, and lastly, psycho-therapy. The thing known as odylic force was imperfectly known thousands of years ago, and less used with perplexing effect by the priests of Thor and Woden, of Osiris and Minerva and many others in very ancient times. And Christ in His time made a most astonishing use of it in healing the sick in His vicinity and doing many other things erroneously called miracles. For, when rightly and scientifically known, there is no miracle about it. for it is founded on natural law as much as is gravity or cohesion or chemical action. It is a primal gift to mankind in conjunction with intellect and being. At Lourdes, in France,

the priests are at the present time working many cures by it under the false title of Divine Healing or miracle. But in most other parts of the world, except in the domain of Eddyism, those false pretenses are discarded and the procedure is given some decent and respectable name, a name that in some cases comports with the reality. The most frequently used modern terms are hypnotism, suggestive therapeutics and psycho-therapy. In France great hospitals are established and endowed for its practice, and such men as Charcot and Lebault have made great reputations in its use and development.

And in this country many institutions make large or entire use of it in the treatment of disease. And probably a majority of our up-to-date medical colleges have each their chair of psycho-therapy as a part of the regular college curriculum. So that the old yet new therapy is gradually gaining the place in practice that rightly belongs to it. But it still holds too small a place in our labors. I have studied and taught this species of therapy for forty years, and some of my most pleasing and satisfactory triumphs have



been achieved through this benign agency alone. I say benign, for that word best expresses the idea of its absolute safety and total exemption from danger or ill effects. I have done over a hundred surgical operations with hypnotism in place of chloroform for the anesthetic with no possible risk to the patient, as there would have been with a chemical anesthetic. And I have in all such cases been able to conduct the after-treatment to the end without pain or complications. In such cases there is no nausea or digestive disturbance and no chemical shock to the nervous system, and with it I have cured hundreds, and probably thousands, of cases of neuralgias and various nervous disorders. It is only within the last ten years that we have known the real basis and scientific formulary of the subject. In 1893 Thomas J. Hudson gave the world the first book containing anything like the true inductive science in the matter. Before that, all was conjecture and empiricism, men blundered and floundered and disagreed wildly over the basic principles of the latter. But he gave us in that book what Hahnemann did in the organ of drug-therapy, the inductive science of the matter, which enabled the world to go on and work out on right lines the real scientific application and results in the new field of investigation and practice.

Since the appearance of Hudson's book many new works on the subject have appeared, all founded on the same lines of investigation. And today there is no longer any valid excuse for any progressive physician to exhibit or plead ignorance on the subject of psycho-therapy. And he who does not master as much as possible of its truths and principles goes about disarmed of one of the most potent factors in the healing art.

I am moved to these reflections on the

subject by reading one of the most recent works on the subject by my former classmate and co-graduate, Dr. Sheldon Leavitt, of Chicago, published last October under the title of "Psycho-Therapy." That work should be read and re-read by all up-to-date physicians of every school of practice, for, like surgery, psycho-therapy is one and the same thing in all schools of practice. And no one has better stated the field and *modus operandi* of psycho-therapy than Dr. Leavitt. In connection with it much will be gained by reading Hudson's "Law of Psychic Phenomena" and his more recent work, "The Law of Mental Medicine." And I feel like saying this to the profession in a paraphrase of the good old Methodist hymn:

Come, my brethren, let us try  
For a little season  
Every question to lay by;  
Come, and let us reason.

—Medical Arena.

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#### Warts and Moles May Be Dangerous.

The members of the American Academy of Medicine showed much interest in a paper by Dr. W. W. Keen, of Philadelphia, on the dangers of warts and moles. Dr. Keen compared a wart to "a match that can produce a great conflagration," and recommended that all such growths should be removed at once while yet in the harmless stage.

The danger of warts lies in the fact that after years of harmless existence something may cause them to spread. Out of twenty-five persons affected by the malignant spread of warts eleven died in spite of operations, sometimes even amputations.

Dr. Keen's hearers agreed with him that every wart and mole should be destroyed at once and said that he had done well in bringing the matter to public attention.

# EDITORIAL

The letter of Dr. Lydston, on page 185, opens up an important question. The combinations so successfully made in the industrial world are a constant incentive to some professional men to go and do likewise. It is not easy to say beforehand whether such combinations will result in good or in evil. If successful, they will be bad for those that are not in the combinations; if a failure, they may be bad for everybody. But whatever our preconceived notions may be, the experiment is certain to be tried, sooner or later. If such combinations prove more economical from a sociological standpoint, they will win, and to fight them will be to fight against social evolution. If they do not prove economical, they will die of their own accord.

Dr. Walter Lindley, the editor of the *Southern California Practitioner*, has recently been elected dean of the medical college of the University of Southern California. This Los Angeles school is now entering its twentieth session. Dr. Lindley was one of the organizers of the school and is professor of gynecology in that institution.

## Book Review.

*The Practical Application of the Roentgen Rays in Therapeutics and Diagnosis.* By William Allen Pusey, A. M., M. D., Professor of Dermatology in the University of Illinois; and Eugene W. Caldwell, B. S., Director of the Edward N. Gibbs X-Ray Memorial Laboratory of the University and Bellevue Hospital Medical College, New York. Handsome octavo volume of 591 pages, with 180 illustrations, nearly all clin-

ical. W. B. Saunders & Co., 1903. Cloth, \$4.50 net; Sheep or Half Morocco, \$5.50 net.

Part 1, by Eugene W. Caldwell, gives an excellent general review of the physical properties of x-rays. The essentials of x-ray equipment are first given. Then follows a discussion of x-ray tubes. In spite of the various forms of regulating apparatus which have been attached to x-ray tubes the regulation of the vacuum, he says, is still in such an unsatisfactory condition that some of the best operators prefer to use simple tubes with no regulating appliance, considering it cheaper and more convenient to keep on hand a large stock of the simple tubes rather than a smaller number of the more costly and elaborate self-regulating tubes. Mr. Caldwell finds also serious defects in the apparatus for interruption of the primary current, none of those used being completely satisfactory. The adaptation of x-ray apparatus to an alternating current without the intervention of a transformer is also a problem still waiting satisfactory solution. The distinction between intensity of x-rays and their quality of penetration is clearly drawn, and the author points out the inadequacy of any of the methods now used for measuring either the penetration or the intensity.

Another defect in x-ray apparatus is the uncertainty of the quality and particularly the want of uniformity of intensifying screens for use with x-ray photographs.

While pointing out the most serious defects in x-ray apparatus, the author is equally careful to describe clearly and fully the best apparatus now in use for fluoroscopy and radiography. Full in-

formation is given for the detailed manipulation during both of these processes.

Almost the only mistake discoverable in this part is found in the picture of a kathode stream from a low tube opposite page 38. The kathode rays in such a tube really cross each other at a short distance from the kathode and diverge from that point as they go toward the anti-kathode.

Regarding the popular but erroneous idea that an x-ray coil should have a potential sufficient to give a spark of fifteen to thirty inches thru air, the author points out that in the old style of coils only those with high potential gave a secondary current of sufficient intensity to do good x-ray work. A properly constructed coil need not give more than an eight-inch spark, but this must be heavy, indicating an intense secondary current.

Part 2, by William A. Pusey, M. D., gives a concise summary of the results of x-ray treatment as gleaned from the literature of this subject and from his own practice, with a large number of reports of cases. In discussing x-ray burns he disputes Kienböck's statement that there is no such thing as idiosyncrasy toward x-rays. Dr. Pusey has recognized in his practice marked variations in the susceptibility of patients, amounting to a difference of four times as much in one case as in another. These differences he finds do not belong to different parts of the skin nor to its color or complexion, but to be "purely a matter of personal equation without discoverable characteristics" upon which they may be predicated. In this view he differs from most writers upon this subject, who find that these differences are due to easily discoverable factors in the patient.

Regarding auto-intoxication, of which many writers have spoken as something to be guarded against during x-ray treatment, Dr. Pusey says he has never seen

any effect that might be attributed to it. This may be due to the fact that he has usually adhered to his original form of apparatus, which is capable of producing at best only a moderate intensity of x-rays, and has probably also attended to elimination as a routine part of treatment. Such conditions of auto-intoxication undoubtedly do occur, and a number of deaths have been in all probability hastened by this result of intense x-ray treatment.

The historic references are numerous, but are neither complete nor reliable. For example, the author says, "The first report of a successful treatment of lupus vulgaris by x-rays in the United States was the very valuable report of P. M. Jones, of California, January, 1900." In the *Chicago Medical Times*, December, 1896, is the report of successful treatment of lupus by x-rays. An excellent summary of the use of x-rays in pulmonary tuberculosis was printed in the *Illinois Medical Journal* of March, 1904, by Carl F. M. Sandberg, which mentions some early work done in the United States of which no mention is made by Dr. Pusey.

The book is well bound and abundantly illustrated. It forms a valuable addition to any electro-therapeutical library.

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#### Government and Wireless Telegraphy.

The Navy Department has decided to assume control of all the wireless telegraph stations on the coast and to prohibit the operation of such stations by private persons or corporations.

This is seemingly only a move to assure the proper defense of the sea coast of the United States. But it is really more than this. It is a step toward the national ownership of transportation. If the government may take charge of wireless telegraphy why not of other forms? Why not of railroads?



### The Chicago Medical Gold Brick.

A worthy gentleman of philanthropic proclivities, a promotor who is alive to the interests of humanity—which is “I,” writ large—has discovered that Chicago is suffering from a lack of hospital accommodations. Incidentally he has discovered that there are a few persons who have escaped the net of the hospital grafter and are still foolish enough to employ physicians and pay them for their services. Bent upon remedying this deplorable state of affairs, he is now in Chicago for the purpose of organizing a “co-operative hospital run on the principle of that much to be anathematized institution, the London Medical Club. The members of the proposed co-operative hospital association are to pay a yearly “membership” fee, and the medical staff is to be “paid for its services.” The principal alleged *raison d’être* of the new scheme is the need of providing accommodations for those “too poor to pay a physician but who can pay something for hospital accommodations.” This tearful plaint of the promotor, conjoined with the “salary” argument, has enlisted the sympathies of a number of prominent medical men who, not content with the grafting that they have, are eager to fly to grafting that hitherto they knew not of.

It is to be hoped that the profession will antagonize this new scheme for imparting a veneer of respectability to dead-beatism. Should such an institution be started, the duty of the profession will be to oppose its operation in every possible legitimate way. More than this, the stamp of disapproval should be put upon every physician who connects himself with the scheme in any way whatsoever. When consultation and operation cease to travel towards such men, they may learn that the selfishness of the individual can not be permitted to obscure that spirit of pro-

fessional altruism which should imbue the spirit of every man who poses as a leader in medicine and surgery. The profession is travelling towards pauperism pretty rapidly as it is; the new scheme would be but the beginning of the end. The day is not far distant—unless conditions change and the profession awakens to the dangers that confront it—when the twenty-five-cent fee of the London Medical Club will be too close for comfort. In thus antagonizing the proposed medical gold brick scheme, I am simply following the line of procedure mapped out to the promotor who laid his plans before me and invited me to join the enterprise on a profitable basis. He asked me what attitude the Chicago Medical Society would likely assume toward the new scheme, I replied, “I do not know, but in so far as my influence will count, it will be war to the knife.” In closing I wish to remark that the co-operative hospital scheme apparently contemplates a chain of the new grafts in every large city in this country.

G. FRANK LYDSTON.

### New Form of X-Light Tube.

Dr. J. Mount Bleyer, of New York City, who has for many years made a special study of light phenomena, has discovered a new composition of glass from which has been constructed an x-ray tube, which Dr. Bleyer claims may be used to generate both x-rays and the bi-ultra violet rays at the same time. The quality and richness of the rays emitted from this tube are considered by Dr. Bleyer to be the finest he has observed. The perfection of a tube of this nature will place in the hands of therapists an instrument of much value in the treatment of lupus and other allied diseases. Dr. Bleyer credits Mr. G. J. Monohan with the construction of the tube.—*Electrical Review*.

### The Medico-Legal Aspect of X-Rays.

With a widening field of usefulness the medical-employment of x-rays becomes a "burning question," and this in its most literal sense. It is true that, so far as the x-ray photograph—the radiograph—is concerned, improved instrumentation has so far shortened exposures that the harmful, inflammatory effect known as x-ray dermatitis, or x-ray burn, need not be apprehended. A five minutes' exposure ought to be sufficient for the most deeply lying organs of the body; and this with the tube at seven inches from the skin involves no risks—whatever be the construction and condition of the tube, the penetrating power of the rays, the number of interruptions, the size of the secondary coil, or the susceptibility of the patient. Prolonged screen examinations for renal calculus have sometimes produced burns for which damages have been claimed; but in the light of past experience such cases ought no longer to be possible. Neither ought the chronic "dermatitis of operators" ever to occur now that the necessity for suitable precautions is properly understood. But the cases that occurred (for instance, amongst hospital operators and others) before the danger was properly realized, still exist, and might constitute reasonable grounds for claim to compensation. Altogether it seems evident to those best able to form an opinion, that actions to recover damages for x-ray burns caused by "diagnostic exposures" will become very uncommon in the future. But in view of the present extensive employment of "raying" for curative purposes, the question assumes a widely different aspect. Here repeated exposures are necessary, and no care and skill, however great, can at present guarantee an absolute immunity from risk. As is well known, ten to twenty days may elapse between the appearance of the

deleterious effects and the exposure which caused them. Nature sometimes fails to hoist the danger signal until the mischief is done. But apart from this the further question arises: How far is a more or less pronounced dermatitis the usual and necessary accompaniment of cure?

It is evident that whoever undertakes the treatment of any morbid condition by x-rays, undertakes a serious responsibility. He must err neither on the side of rashness nor timidity. Especially must there be a complete understanding, perhaps even expressed in writing, that the patient is aware of the nature of the treatment, and is willing to accept its attendant risks or necessities. All this seems self-evident, yet a reference to the reports of cases that occasionally find their way into the law courts seem to show that these precautions are not always taken, and these responsibilities sometimes ignored. A case reported in the columns of this journal on May 20th, is instructive reading in this connection. Here a medical man sued the husband of the patient for payment of professional fees, and the finding of the jury was to the effect that "the defendant did not consent to the x-ray treatment, and that the treatment was improper, negligent, and unskillful." In the face of the medical evidence, it is difficult to see how any other verdict could have been returned. If the treatment was applied without the knowledge and consent of the patient's husband, it was certainly, in this sense improper. If it was deputed at one time to a layman, and at another to a nurse, it was certainly negligent, and this is a point by no means sufficiently insisted upon in the trial. That it was unskillful, seems to have been considered proved by the very extensive burning produced. Whether the medical evidence as to unskillfulness, and, indeed, other points would quite satisfy a critical observer, is,

perhaps, another question. It seemed to be the impression of at least one witness that "if h. f. currents could do no good, they could do no harm." Such a view does not accord with the experiments of Bordier and Lecompte, who have demonstrated that such currents showing on d'Arsonval's instrument a milliamperage of about 500 can kill or paralyze small animals such as rabbits. Surely, therefore, high frequency currents must have some potentialities for mischief even in man. The same critic might even go further and demur to the very dogmatic utterances of some of these witnesses with reference to the inability of x-rays to penetrate beyond the skin and to influence internal disease. Again, in view of the fact that the "mechanism" of the x-ray burn has never yet been elucidated, the same observer might be surprised to learn that such burns can be "effectually prevented." Further, the same censorious person might refer to the fact that some operators think (and they have a right to their opinion) that a certain amount of dermatitis is the more or less necessary accompaniment of cure; he might even go bluntly to ask, in his own objectionable way, how far it is proper to tell a jury that every precaution ought to be taken to prevent such effects upon the skin.

Passing from the main issue certain reflections suggest themselves bearing on the whole question. In view of all that is known on the subject, has the medical employment of x-rays really reached that measure of scientific precision that might be expected? Knowing, as we do, how to sift and separate one from another the various radiations that proceed from an x-ray tube, why is there no record of exact experiments to ascertain what is the actually harmful agent—what the actually helpful one? Consider for a moment the chief components of this compound radi-

tions: Ultra-violet rays, alpha rays, kathode or beta rays, x or gamma rays. Of these it is known that the ultra-violet have but little penetrative power—a pocket handkerchief will stop them. With ease the alpha rays may also be intercepted. Much more difficult to arrest are the kathode and the x-rays, but here we have only to remember that the former can be deflected by a magnet and thus eliminated, leaving only the x-rays. But besides these radiations, there are also to be reckoned with certain chemical or oxidizing effects, and also electrostatic effects. From the latter the skin can easily be protected by various devices, such as an earthed aluminium screen. The ionizing, or oxidizing, effect requiring, as it does, the presence of oxygen, might presumably be eliminated, as suggested by Sir Oliver Lodge, by employing an atmosphere of hydrogen, or applying a tightly fitting cover to the part, or in other ways.

It thus becomes evident that whatever be the deleterious or burning agent it can theoretically be eliminated. But again crops up the ever-recurring question—is this elimination desirable? Can we do without the effect in question? This chemical, or ionizing, or oxidizing action of the ray upon the air in contact with the tissues may be the cause of the burn, but there is, at least, an equal possibility that this very same chemical effect is the active agent in the destruction of the morbid growth. Such a hypothesis might help to explain the destructive effect of raying upon surface growths, its failure to influence the deeper tissues (which it certainly penetrates) being ascribable to the absence of oxygen; and those burning effects sometimes seen on the skin at the side most distant from the incidence of the rays might similarly be accounted for. Given the co-operating presence of oxygen, the x-ray might be able to influence



even deep-seated tumors; and it is quite possible, as suggested by Sir Oliver Lodge, that, before long, we may find ourselves working on these lines.

What can be said of radium in this connection? Although the egregious claims and irresponsible statements that quickly followed on its first discovery have now, happily, given place to sober judgment and sound work, it can not be said that much has hitherto been accomplished by the medical employment of radium. It is not exempt from the risks of the x-ray, but it certainly presents considerable facilities for application in certain difficult positions, and its gamma

rays doubtless excel the x-ray in penetrating power. But then, again, as already insisted on, mere penetrating power is not all that is required; the x-ray has penetrated many a morbid growth, which, nevertheless, it has proved powerless to influence. Practical experience must be accumulated; we must be content to watch and wait and work with an open mind. But, in the meantime, unless it can be proved that radium can do something more than cure a rodent ulcer, it can not claim superiority, or even equality in a comparison with the radiations of the focus tube.

—*London Electrical Review.*

### Electro-Culture.

An interesting and at the same time an encouraging renaissance has lately been observed in various parts of Europe. This is the movement that has lately taken place, after many years of neglect, in favor of the application of electricity to agriculture, not only in the driving of all kinds of agricultural machinery, including the plow, but also in the influence brought to bear by electricity itself on vegetation and germination. In France quite recently the minister for agriculture sent to prefects and sub-prefects a circular instructing them to facilitate in every possible way the application of electricity to agricultural operations, and setting forth the advantages that agriculture and industry in general would derive therefrom. In Belgium still further progress has been made, as the interesting question of electricity in agriculture has been introduced into the university curriculum. The minister for agriculture has found the subject of sufficient interest for him to commission M. Guarini to devote to it, at the Agricultural Institute at Gembloux, a series of lectures on the ques-

tions we are about to enumerate.

We will not go into the description of the numerous experiments shown by the lecturer, nor into the contradictory results obtained by experimentalists in different countries. As to the latter, we will merely remark that the products obtained by electro-culture are very abundant, very fine and very quickly matured. We will confine ourselves to the ideas put forward by M. Guarini, with special regard to his theories for the chemical and mechanical explanation of the satisfactory results obtained by the application of electricity to vegetation. For the last forty years, particularly since the researches of the German scientist, Sachs (1865), our ideas with regard to vegetable physiology have been fairly definite. We can now easily explain to ourselves the function of each part of the plant, the *raison d'être* of each organ and of its form. Moreover, we know a great deal about the function of chlorophyll, in particular of what it consists and what it requires to stimulate its production and to render it more active.

But on the other hand we are completely in the dark as to how and by what means carbonic acid is decomposed in chlorophyll into carbon and oxygen.

M. Guarini asks whether, in these days, where so many things are explained by electricity, we are not justified in thinking that plant life also is based on electrical phenomena; he asserts that this is so. In the first place, he remarks that, contrary to what is believed and taught, it is not electricity that can be substituted for light in certain cases in the accomplishment of the function of chlorophyll, but the light of the sun and of arc lamps, with its electrical radiations, that can be substituted for purely electrical treatment. We have the best proof of this statement in the following experiment:

A plant placed in a pot which is inclosed in a metal cage (a Faraday cage) dies, altho it is exposed to the sunlight. This, says M. Guarini, is because the plant is deprived of the *indispensable* influence of atmospheric electricity, and particularly of the electric radiations of the sun. On the other hand, if a plant is placed in absolute darkness it can produce much finer and more abundant fruit in less time than under natural conditions if judicious electrical treatment is applied to it. With regard to the experiment with the Faraday cage, for the plant to die it must be in a pot completely surrounded by the metal cage. When the plant is in the earth, altho we suppress the influence of the solar radiations and of the current going from the atmosphere to the earth, we do not completely suppress that which passes from the earth to the atmosphere. Every time it rains, hails or snows, for instance, the potential of the earth changes from its usual negative nature to positive.

M. Guarini reminds us that in the Faraday cage we have no charge inside if we have one outside, but we get one outside if we have one inside. When a plant is placed in the earth and surrounded by a metal cage it does not completely perish, but, as Messrs. Grandeau and Leclerc's experiments have shown, there is a diminution of 50 to 70 per cent in the leaves and stalks, and 50 to 60 per cent in the seeds and fruits, as compared to what it bears when there is no cage.

After this introduction, M. Guarini explains as follows the influence of electricity on the principal vital functions of the plant, i. e., nutrition, respiration, and transpiration.

#### NUTRITION.

1. *Aerial Nutrition*.—The current which passes through the plant from the atmosphere to the earth, or vice versa, decomposes the carbonic acid in the chlorophyll into carbon and oxygen. M. Guarini then performs the following experiment: He injects carbonic acid into a vessel of water from which proceed two electrodes connected with a current of 110 volts. There is at once a deposit of carbon on one of the electrodes. He announces, moreover, that he has obtained formic aldehyde in collaboration with Dr. Samarani of the Agricultural Institute at Gembloux. Special conditions of voltage and amperage are required for this. All this is perfectly in accordance with the experimental results obtained by the Russian Walther in his experiments on the synthesis of sugars by electrolysis, in which the original material consisted of carbonic acid.

2. *Nutrition in the Earth*.—The currents which pass through the earth whether natural (earth currents) or artificial (generated by batteries, accumula-

tors, dynamos, etc.), decompose the chemical substances found in the earth or added to it in order to form nourishment more easily assimilated by plants.

3. *Distribution of Aliments.*—Mr. Guarini pointed out that in arc lamps on the one hand, and electrolysis on the other, material was conveyed from the positive to the negative pole; he also referred to the experiments of Prof. Lemström, of the University of Helsingfors, who was able to make water rise in a capillary tube immersed in a basin, in which was placed the positive pole of a static machine, the negative pole of which was connected with a point touching the upper part of the capillary tube. When, therefore, the potential of the earth is positive, or rendered so artificially, and the potential of the atmosphere is, above the plants, rendered negative, the current which goes from the earth to the atmosphere draws with it the water and alimentary substances, i. e., promotes the circulation of the sap.

#### RESPIRATION.

This means the inhalation of oxygen through the pores of the capillary vessels. When there is a current passing from the atmosphere to the earth, the oxygen is carried along in the direction of the current—i. e., downward—and is driven out with more or less force through the pores, and thus respiration is kept up.

#### TRANSPIRATION.

This consists in the plant giving off the products of combustion, carbonic acid and aqueous vapor. When there is a current passing through the plant in an upward direction, the result is contrary to what takes place in respiration—i. e., the current drives the gases of combustion out of the pores.

To all these chemical and mechanical effects must be added another of considerable importance. Prof. Lemström shows

that when a high-tension electric current is applied to plants, there is produced ozone in large quantities, nitric acid, nitrous acid, and, perhaps, ammonia. Now, we know that the oxygen derived from the ozone is highly active, as is shown by the increased verdure of plants after a storm. From what M. Guarini says, it follows that for respiration the plant must be traversed by a current going towards the earth, whereas for transpiration the current must go towards the atmosphere, whilst in the case of nutrition the direction of the current is immaterial. As nutrition and respiration are the two most important functions of plant life (transpiration being a consequence of these two functions), it follows that the best result is obtained when the plant is traversed by a current going towards the earth, which would correspond to the normal electric condition of the atmosphere and the earth. Mr. Guarini, in order to prove that experiment agrees with theory, showed photographs obtained by Prof. Lemström during his experiments with a static machine of his own invention. With the aid of these photographs one can see and compare the results obtained from carrots, the layer of atmosphere surrounding them having been electrified (1) positively, (2) negatively, (3) positively and negatively, and (4) not electrified at all. When the atmosphere is electrified negatively, i. e., when there is a current towards the atmosphere, the carrots are better than when there is no electrical treatment.

In this case, as we have said, there is increased activity of nutrition and transpiration. The results are incomparably better when the atmosphere is electrified positively, i. e., when the current goes towards the earth. In this case, we not only force respiration and nutrition into



greater activity, but—and this is most important—we send into the plant a greater quantity of carbonic acid, i. e., a greater quantity of nourishment.

The illustration presented by the lecturer also showed that very deplorable results were obtained when currents of both kinds were applied.

Finally, the lecturer remarked that in order to derive the greatest benefit from electrical treatment it is necessary: (1) to place the plant in an environment where there is much more carbonic acid than in the atmosphere. This can easily be done in glass houses that are entirely closed; (2) to accustom the plants, perhaps, after a certain number of generations, to forced alimentation, transpiration and respiration, and so to a much more rapid mode of life.

By these methods and by judicious electrical treatment, production can be pushed to extreme limits, and several crops a year obtained.

As to the sources required for the electrical treatment, M. Guarini mentions the three following:

1. Atmospheric electricity. None of the arrangements employed completely answer the purpose required. The sources of the atmospheric currents must be placed in much higher positions than they have yet been, so that there may be sufficiently high differences of potential between the top of the rods and the earth, and sufficient to overcome the resistance of the plants and of the layer of air separating the lower part of the rods from the plants, that part of the air in which currents are produced and consequently ozone.

2. Static machines. He rejects these for the present as expensive and delicate toys, easily put out of order, and incapable of producing the intense effects required.

3. High-tension continuous-current dynamos; these are both inexpensive and strong. By using them instead of atmospheric electricity, the electrical treatment can be regulated at will.

M. Guarini mentioned in this connection that the Société des Industries Electriques et Mécaniques, of Geneva, has recently brought out a continuous-current dynamo capable of giving one ampere at 23,000 volts, and that by coupling three of these machines in series, the high figure of 69,000 volts is obtained, a value more than sufficient for electro-culture.

Lastly, he concludes that plant life is an electrical phenomenon which can be regulated at will. The farmer will no longer be a mere machine, but a skilled and more or less intelligent electrician, who, like an engine driver, will direct from a board at the farm the germination and growth of his carrots, potatoes and cabbages.—*London Electr. Rev.*

#### **New Theory on Polar Currents.**

The latest word in meteorology is brought from the international meteorological committee, which will render it necessary, it is said, to abandon once for all the theory hitherto adopted of a vertical circulation of the atmosphere between the tropics and the poles. Dr. H. H. Hildebrasson, who makes a report, expresses the hope that the terms "polar" and "equatorial" currents, which have hitherto caused so much confusion in dynamical meteorology, will disappear completely from meteorological science.

He shows that in all parts of the temperate zone of the northern hemisphere an and upper current from west to east prevails in all months of the year, while in the tropical zone the currents at all heights are almost without exception from east to west.

### Experts on Cancer.

Important conclusions in connection with cancer were announced when the Prince of Wales presided at the annual meeting of the general committee of the cancer research fund. Distinguished experts briefly summed up their year's work as follows:

Civilization is not the cause of cancer, which pervades animal as well as human life and attacks all its subjects at relatively the same age and periods.

Cancer is not an infectious disease and is not transmissible from one species to another. A cancer cell can reacquire powers of self-propagation.

Cancer is not caused by a parasite.

The malady is not on the increase.

Radium has been found to exercise no curative effects.

A serum has been discovered from which good results are hoped.

The first authentic cases of cancer in animals were minutely described by experiments which had been made on fish and wild mice.

The Prince of Wales urged the public to consult the surgeons at the first indication of any cancerous symptoms, though the report of the experts said that no sign has yet been discovered by which medical men can surely recognize the presence of cancer.

### More Surprising Properties of N-Rays.

In addition to the other surprising properties of n-rays, it is now stated by well known scientific men that n-rays—or, rather, those substances which have the property of emitting these rays—are affected by anesthetics. A statement to this effect was made recently by Meyer, who found that plants subjected to chloroform lose their power of emitting n-rays. His work has been carried further by Becquerel, who has investigated the influence

of anesthetics on other sources of this surprising form of radiation. He found that several inorganic sources of n-rays lose temporarily their power under the action of chloroform, ether, or nitrous oxid. These experiments raise the question whether the emission of n-rays is a fundamental vital process. If so, where lies the dividing line between organic and inorganic bodies? In view of other investigations of a somewhat similar character, altho along an entirely different line of research, this topic is becoming of increasing interest.—*Electr. Review*.

### Cancer Research Abandoned.

That the researches in regard to the etiology of cancer have failed miserably is a melancholy fact, but true nevertheless. We are as much in the dark in regard to the cause of this dread disease as we ever were. The New York Senate Committee on Finance has, after spending \$100,000, refused to appropriate any more money for the maintenance of the Buffalo Cancer Laboratory, asserting that nothing could be shown for the money expended.—*Georgia Medical Journal*.

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# THE AMERICAN X-RAY JOURNAL

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PROF. W. E. GOLLSBOROUGH

Chief of Department of Electricity, Universal Exposition of St. Louis, 1904

# THE AMERICAN X-RAY JOURNAL

Devoted to Practical X-Ray Work and Allied Arts and Sciences.

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No. 1

## A Cell Tonic Adjuvant in X-Ray Therapy.\*

BY HAMILTON FORLINE, M. D., CHICAGO.

During the last few years much has been written on the subject of x-ray in the matter of its application to the relief of many pathological states hitherto more or less, if not entirely, resistant to known methods of treatment. Much credit has been given it by enthusiasts which probably it does not deserve, and without doubt there remains much of value to be revealed by the many tireless and conservative men now engaged in an earnest endeavor to define its exact place as a therapeutic agent. With this, as with all new remedies, some of us are prone to assign to it virtues not possessed, by drawing conclusions based upon evidence which greater experience will show to be erroneous. Without presuming to criticise the claims made for the x-ray or attempting to inform this learned body of its apparent manifold merits, I wish to dignify the remedy by briefly discussing the probable value of adjunctive agents in some of its fields of usefulness.

That the x-ray possesses an unmistakable power to modify certain cell metamorphoses is believed when we study the clinical evidence at hand. If we are to admit the truth of the many reports of physicians in America and Europe chronicling the dissipation of malignant neoplasms, the cure of certain forms of tuberculosis and other microbic diseases, superficial and deep, the removal of hair, cuticle, and the performance of many other interesting

therapeutic feats, we become at once impressed with the immense possibilities of this comparatively new principle in therapy. It does not follow, however, that such results as are claimed for the remedy may be best acquired unaided. Further research and more accurate observation will lead to the discovery of many essential accessories, but none in our present knowledge appeals to me with greater force than the cell tonic adjuvant, particularly in the x-ray treatment of malignant growths. It would seem, if the present theory of the action of the x-ray in malignant disease is correct, namely that it changes the position of the ions, breaking up, so to speak, the existing bacterial or cellular arrangement of the growth, thus rendering it highly important that the individual integrity of the normal cells should be sustained in every possible way—that a cell tonic of great potency is imperatively indicated.

Without discussing further the x-ray's specific action, I will call your attention to some data relative to an adjuvant, which, in my judgment, is of great usefulness. Of the various cell tonics included in our armamentarium which have been used in this particular field, greatest preference has been given to the tonic principles derived from normal animal fluids and cells, because in this instance they are more easily decomposed into their consti-

\*A paper read before the American Electro-Medical Society.

tuent elements by the x-ray and thus act more efficiently. Thus nuclein, protonuclein and spermin phosphate have been selected and proven serviceable.

Four years of careful and extensive use of a powerful direct cell tonic composed of pure animal lymph, orchitic fluid and blood serum, furnishes me with material which I believe justifies me in drawing conclusions relative to its value. The opportunity has been mine to observe its action in a great variety of chronic diseases and I am convinced that it is by far the most powerful cell tonic now in use.

To exemplify the degree of its cell tonic effects I shall cite, briefly, a few commonly obtained results in chronic infections and degenerative diseases.

CASE 1.—Male, age twenty-four, family history negative; had pneumonia four years ago which left him with a persistent cough. Examination revealed a very severe and extensive infiltration of both lungs, principally the right. He was markedly emaciated. Several small cavities in both lungs in and below apices. Profuse purulent expectoration, teeming with tubercle and pyogenic micro-organisms. Temperature on admission 101°. Heart fattily degenerated and markedly asthenic. Blood count three million r. b.c. to the c. m.; percentage hemoglobin sixty-five. Case was of a rapidly progressive type. Results of treatment in thirty-three days: Temperature, 98.6; cough greatly lessened; expectoration diminished and changed to mucus; gain of fifteen pounds in weight; night sweats entirely absent. Examination of sputum shows very few tubercle bacilli.

This case illustrates very well the powerful cell tonic action of the treatment, as it had only been used thirty-three days and was given during the worst part of the winter season of the present year, the season during which Chicago has had her

greatest mortality in pneumonia and other lung diseases.

A case of tropical dysentery in a man thirty-three years of age, treated by me three years ago, who with five friends had drunk some water in a semi-tropical country, soon after which they were all attacked with an entero-colitis of a very severe character. His five friends all died of the trouble. On admitting this case his condition was as follows: Severe catarrhal inflammation, with extensive ulceration of the large and small intestines; microscope revealed the presence of the amoeba coli in the discharges, together with the bacillus coli communis and pyogenic microbes. He had lost about forty pounds in weight, was very anemic, had a nearly constant temperature of 101 to 102, rapid pulse, presence of blood and large quantities of mucus in stools, increased quantity of urine with high specific gravity and a trace of sugar. A clear case of tropical dysentery in which treatment is rarely successful.

This case was given fifteen minims of the lymph-orchitic fluid compound twice daily, and a suitable diet. We persisted in the treatment three times daily for about three months, giving simple stomachics and mild cathartics when indicated. The patient was practically cured. Gastro-intestinal symptoms almost entirely disappeared, he gained about twenty pounds in weight and other symptoms were removed.

A letter from this patient a month after he was discharged states that he still continues to improve in every way.

Being fearful of tiring you with a long list of results, which I could recite indefinitely, I wish in conclusion of this part of the subject under consideration simply to add results in general and the recitation of a single case in a typical degenerative disease, namely, locomotor ataxia.



In locomotor ataxia I have succeeded with this remedy as a basic treatment, and purely as a result of its cell tonic properties, in 75 per cent of cases treated (which have been a large number) in relieving pain, decidedly lessening the ataxia, restoring sphincter control when lost in not too advanced stages, and in apparently stopping further progress of the degeneration. I do not wish it to be understood that I vaunt this agent as a cure for locomotor ataxia, but I believe it to be by far the most valuable treatment we have for this disease at the present time.

The case I shall report is representative of a result obtained in decidedly a minority of cases and is one of the few in which I think I am justified in stating that a practical cure has resulted.

Man, age thirty-seven, specific history. Disease began ten years ago, with lightning pains which were diagnosed and treated as rheumatic. Five years later he began to note impairment in gait with a development of anesthetic zones in back and legs below the knees, cushioned feet, the girdle sensation, vesical incontinence and rectal sphincter weakness. At the time of examination incoördination was marked being unable to stand alone. A-R pupil present. There was also a definite arterial thickening. In thirty days after he began treatment, by the supra-dural method combined with subcutaneous injections, the pains were very much diminished, gait and other symptoms seemingly not affected. At the end of sixty days incoördination was slightly improved, pains still less, and he had better control of bladder and rectum.

The patient was treated ten months, at the end of which time he was discharged, with gait practically normal, pains entirely absent, perfect bladder and rectal control. In fact, he was in a condition

such as to render it impossible to detect, except by closest physical examination, any evidence of the disease.

Such results as the above have been accomplished not only in my own work, but have been reported by hosts of physicians all over this country. For the benefit of those not conversant with the formula, etc., of this cell tonic referred to, I will briefly state that it is for hypodermic use only, is a sedimentary fluid—the sediment being composed of intact lymph cells and spermatozoa. It is composed of pure unfiltered lymph obtained from fresh lymph glands and ducts combined with concentrated orchitic fluid, preserved in a menstruum composed of carbon water and blood serum, to which is added a small quantity of chloride of gold and sodium. Notwithstanding the sediment of intact cells, the remedy when injected produces no reaction or local irritation, it often having been injected to the dura-mater (spinal and cerebral), as well as into the subarachnoidean space and peritoneum, in none of which situations has it produced the slightest evidence of harmful reaction, either immediate or remote.

At the present time I am injecting the fluid directly into the body of cancerous growths, with apparently no local reaction of a deleterious nature. It seems, in the light of our experience so far, with the combined x-ray and cell tonic treatment, that a valuable addition to methods has been instituted. The following case reported to the local society in January this year is interesting in this connection:

A man fifty-five years of age had been suffering from a small-celled sarcoma of the ocular cavity; he had been submitted to all forms of treatment for this condition for a period of twelve years without any benefit. One year ago he was given treatment by the x-ray for this condition

and continued it ten months without any change. At the end of ten months we started in with ten-drop doses twice daily of this Lymph-Compound, and at the end of sixty days of treatment the inflammatory area was much diminished, an active healing process was noted and this improvement continued until there were evidences of a perfect recovery.

This case is particularly instructive, as the x-ray, with many other forms of approved treatment, had been faithfully applied without any change whatever in the character or condition of the growth, and not until the administration of the cell

tonic did we get any results.

In conclusion I have no apologies to make for dwelling upon a remedy which has here and there met with some adverse criticism from a few medical men who were not accurately informed regarding its true character, because the clinical evidence accumulated during the last six years has given it a standing which is bound to meet with universal recognition. No doubt there are many other adjunctive measures to be considered in this connection, but I shall leave their discussion to those better informed in their relative values.

## Psycho Therapy.

BY SHELDON LEAVITT, M. D.

"Don't get into such a narrow channel, be broadminded and willing to prove all things, and hold fast to that which is good. All wisdom does not reside in allopathy, homeopathy, osteopathy, electrotherapy, or any one of the pathies, but there is a semblance of good in all of them."—*Dr. J. R. Etter.*

The man of science should not think for a moment that he has reached finality in the study of phenomena, and usually he does not. At the same time it is wholesome to be reminded of our shortcomings. An ancient monarch commissioned a dependent to solemnly caution him every morning with the declaration that he was mortal.

### BEYOND THE ATOMS.

While the following suggestions are commonplace, they are in an impressive setting, and, for this reason, are worth reading. There is little new under the sun; it is the unconventional way of putting truths that gives them their freshness.

Not long ago an atom was the smallest known division of matter; but now we

have electrons, the constituents of atoms, which make an atom itself look like a miniature universe.

And the electrons: what are they? Who can yet say? They are expressions of *energy*; and so is *thought*; and so is everything, whether visible and invisible. We have need to beware how we establish limitations—both for ourselves and other potentialities.

When an electrical charge is passed through a Crookes tube, one sees a beautiful velvety greenish glow inside the tube. This is due to the incandescence of tiny fragments of matter traveling at an incredible speed.

They are electrically charged corpuscles named electrons. The electrons make up or compose the atoms of matter. Atoms are small things—very small; three hundred millions of atoms placed in a row would not measure quite an inch. A granule of starch would equal in size a trillion atoms. An atom is an aggregation of electrified corpuscles—electrons. Electrons are very small, probably a thousand million times in bulk smaller than an atom. An electron, for size, may be compared to atoms as a dust mote to a good-sized church edifice.

Clusters of these electrified corpuscles (electrons) build up the different kinds of matter, the "elements" of the chemist. They are the stuff of which all existing things, man, monkeys, sticks, stones and worlds are made.

#### EFFECT OF ANESTHETICS ON X-RAY PHENOMENA.

M. Jean Baequerel, a French investigator, has found that the n-rays emitted by animals are checked when the latter are put under the influence of chloroform. When the effect of the anesthetic has passed, the emission of the rays begins again.

Continuing, he found that flowers, which usually sent out the rays, when chloroformed, also went to sleep, and ceased to give them out; and even inanimate and inorganic substances responded in the same way, stopping the emission when under the influence of chloroform, and beginning it again when the effect might be supposed to have worn off. In short, it seems that anesthetics actually send to sleep metals and flowers, as well as animals.

This throws some light on the phenomena of sleep which has appeared to be little else than an inhibition of so-called consciousness. It is more and more evident that our knowledge of the essential nature and prevalence of mind is but fragmentary. Let both materialists and non-materialists tread softly.

#### DO THOSE WHO INHERIT QUALITIES MERELY REMEMBER THEM?

A German writer maintains that memory is a universal function of organic matter and that heredity is merely one phase of it. Memory is often conscious, but not always so. When unconscious, it results in automatic or reflex acts. When the eyelid closes before a threatened blow, the action may be regarded as the result of unconscious memory. Such instinctive action occurs even where there is no real nervous tissue, as in the lower organisms, and in plants. The turning of a sunflower toward the light may be looked upon as an act of unconscious memory. Between this kind of memory and heredity we can

not draw the line. According to the new theory the reappearance of a parent's qualities in the offspring is due to the reproduction of experiences undergone by the germ while still an organic part of the parent's body—in other words, to the "remembrance" of these experiences. "Every living being of today," in the words of an exponent of this theory, "is the product of the unconscious memory of organized matter."

This is a view of heredity that appears to be most rational and intelligible, and one that makes our tendencies more controllable. Psychologists have long maintained that reiterated auto-suggestion is capable of breaking the power of hereditary influences and of turning vital energy into new mental and physical channels. The foregoing hypothesis, then, concerning the nature of heredity gives us stable theoretical grounds for certain claims of psycho-therapy. The memory of what has usually been done can surely be shorn of its power as a determiner of subconscious action, if only the purpose be adequately strenuous and persistent.

#### THE DUAL NATURE OF DISEASE.

"The truth remains that no disease is purely mental, any more than any disease is purely physical. Hence material and mental remedies, not only empirically, but scientifically, go well together."—"The Personality of the Physician."

Up to the present moment there has been a manifest disposition of the greater part of the profession to look upon nearly all physical ailments as purely physical, and accordingly as demanding only physical remedies. A constantly increasing number of observers, both professional and lay, have thought otherwise, believing that the springs of disease lie in the realm responsive to neither chemical nor microscopic research. More than a century and a half ago that greatest philosopher of re-



cent centuries, Immanuel Kant, declared that "Time and space have no existence apart from mind. There is no such thing as sound (the sensation) unless there be an ear to receive the vibrations. Things and places, matter and substance, come under the same law, and exist only as mind creates them."

The same philosopher, possessing a feeble constitution, himself just five feet tall, with a slender body and mammoth head, at a time when assured that there was little to hope for from physical sources, nightly wrapped himself up in the bed-clothes and resolutely exclaimed to himself, "How comfortable I am! How comfortable I am!" And what was the effect? Could a man grow worse under such treatment? He grew strong and well, maintaining his health till the last few months of his life, which extended to the eightieth year.

Latterly the profession, with noticeable unanimity, have come to admit that some diseases are partly mental in origin, but they have endeavored to restrict the list to those of a distinctly nervous type. Few

are willing to admit that disease of an organic nature, presenting objective pathological features, such as carcinoma, fibroma, tuberculosis, etc., have distinct roots running deeply into the substratum of mind.

A determining factor of importance in the ordinary opinion concerning the etiology of disease lies in the common supposition that mind is wholly represented in consciousness. It is presumed that what the mind does not sense has no existence: that one has no unconscious phases of mental activity, all phenomena of seeming intelligent and purposive action, not springing from conscious mind, being referable to sensory-motor reflexes.

It is the mission of the New Psychology to broaden the view concerning disease etiology so as to include as prominent factors in the production of morbid phenomena, subconscious, or unconscious, mental concepts.

The medical profession has to learn that by far the greater part of mind lies below the threshold of consciousness and that into this part of mind are traceable the rootlets of *all* forms of disease.

## Recent Advances in X-Ray and Electro Therapeutics.\*

BY ELMORE S. PETTYJOHN, M. D., AND T. PROCTOR HALL, PH. D., M. D.

In the autumn of 1895 Professor Roentgen discovered the x-rays. At that period electro-therapeutics was condemned by the great majority of physicians. This condemnation was the result of prejudice, it is true, but was a not unnatural consequence of the fact that most of those who undertook to use electricity were extremely ignorant and exploited the most fantastic absurdities. These were the fools that rushed in where angels feared to tread, until by and bye the path became so well beaten that even angels were not afraid to walk there.

The physicians knew also that they themselves (the angels) knew nothing of electricity and shrank from attempting to use an agent which seemed so utterly capricious and unbridled in its effects.

A few years ago it was not uncommon to hear expressions of intense animosity against electro-therapeutics from well informed physicians. It was called a fake and was to be avoided by any self respecting doctor. Such expressions are no longer a sign of prejudice, but only of ignorance, and this ignorance is rapidly giving away before the light of scientific research.

\*Read before the American Electro Medical Society at Chicago.

Electricity had been used more or less for ages in the treatment of disease, mostly by men who did not profess to be physicians. After the discovery of the voltaic pile, a little more than a hundred years ago, many physicians experimented with this form of energy. There were some successes and innumerable failures. Even after the chemical and physiological properties of the electric current had been carefully investigated, this knowledge remained in the hands of a very few, and most of the experiments in electro-therapeutics continued to be made by men who knew next to nothing of electricity and still less of therapeutics. This sort of thing continued, with variations, up to the close of the last century.

In the year 1895 most of the static machines were small and were possessed by men who knew little or nothing of their therapeutic uses. As soon as it was found that these could be used to furnish the current for an x-ray tube, the demand for static machines became very much greater. Manufacturers vied with each other in producing better and cheaper machines which they advertised widely, calling attention to their value for electro-therapeutic purposes as well as for producing x-rays. This more than any other feature has led to a much more extended use of electricity in therapeutics during recent years. It is still unfortunately true that four-fifths of the physicians who own electric machines know next to nothing about their therapeutic uses, but there is and has been for several years a rapidly growing interest in electro-therapeutics. The science itself is becoming more clearly defined and is attracting the attention of some of our best educated men, so that today the physiologic and therapeutic properties of the various forms of electricity are as well known as those of any drug in common use. To make this knowledge

common to the great body of the medical profession will require time.

In the application of the galvanic current there has been little that is new during recent years. Methods which were used long ago, and which were abandoned by many physicians and surgeons as worthless, because these physicians and surgeons did not know enough about electricity to use the methods intelligently, are now coming into more general use.

The invention of improved apparatus has greatly facilitated the wider use of electro-therapeutics.

Finsen's experiments in the cure of lupus and other diseases by light gave a great stimulus to investigation in both radio-therapy and photo-therapy.

At the present time electro-therapeutics has passed its babyhood and is a strong and lusty youth. Its constitution is well established and it is making its way on its own merits without asking any favors. In the mechanical arts a greater variety of effects may be produced by means of electricity than by any other single agent. The same is already true of electricity in medicine. There is no other single agent by which so many different abnormal conditions may be overcome by one who understands this force.

It may be in order now to briefly outline these effects. The positive electrode, or anode, produces acids, which are astringent and constrict the smaller blood vessels, thus diminishing the blood supply to that part. This electrode can be used to reduce inflammation in the acute stage, whether of nerves, muscles or other tissues. When the current is concentrated at the anode it coagulates the albuminoids and produces a hard scar. The anode also oxidizes the tissues, and can be used for reducing excessive muscular excitability such as is found in chorea.

The negative electrode, or kathode, is the direct opposite of the anode in all its effects. It is alkaline, softens and hydrates the tissues, and increases the blood supply. It can be used for increasing the nutrition of any desired part. The alkali has also the power of softening dense connective tissues so that, by its continued use in moderate degree, strictures and other forms of scar tissue can be removed without pain or danger. Abnormal growths in the epithelial or connective tissues may be dissolved by the needle kathode. By the application of the same direct or galvanic currents, using the anode or the kathode as may be required, medicaments can be carried into the body from the surface. This process is known as *kataphoresis*. The medicaments are not, as is sometimes taught, carried bodily thru the skin; but, as in all cases of electrolysis, are broken into ions of which one set, the kations, which are the metallic, basic, or alkaline parts of the molecules, move downward toward the kathode; while the other set, the anions, which are the acid parts of the molecule, move up stream toward the anode.

The alternating current, of which the faradic is a crude example, shakes up the elementary constituents of the cells and stimulates metabolic changes. It can be used to advantage in all cases in which the tissue changes are defective. Of course elimination must be carefully looked after at the same time, else poison may accumulate in the blood, and the last stage of that man may be worse than the first. High frequency currents and so-called wave currents are varieties of the alternating current and produce similar effects.

Coming now to the x-ray itself we find that, beginning with its first therapeutic application by Dr. H. Preston Pratt, of

Chicago, in April, 1896, there has been a fairly steady advance up to the present. The first stages were slow. People in general and physicians in particular were slow to believe that there was any therapeutic value in the silent and invisible rays from a Crookes tube. For several years it was the fashion to ridicule or denounce the claims of those who were experimenting with the x-rays. But the successes were so marvellous that they commanded the attention of the public, and the public were so insistent that physicians were compelled to give some attention to the x-ray therapeutics. The most brilliant result in x-ray therapeutics is the cure of numerous cases of malignant diseases which have defied every other form of treatment. Sarcomas under its benign influence gradually melt away and disappear. In fact, if there is such a thing as a specific for an abnormal condition we are reasonably safe in making the statement that the x-ray is a specific for sarcoma. Carcinomas are not so rapidly overcome by the x-ray, but in the hands of experts it is exceedingly rare to find one at or near the surface of the body which can not be destroyed by this means. Carcinomas in the interior of the body are difficult to reach effectively by x-rays, both because the x-ray tube is necessarily further from the tumor, and because of absorption of a considerable portion of the x-radiance by the intervening tissues.

The x-ray increases metabolic changes, acting in this respect in the same way as the alternating current and waves of light. But the x-rays have the advantage in being able to penetrate any kind of tissue and thus may be made to reach and act upon any desired portion of the body. By their combined powers of metabolic acceleration and irritation they are able to cause the solution and absorption of a con-



siderable number of abnormal deposits, as for example fibrous adhesions after inflammatory conditions in or about a joint. Many kinds of infections are quickly overcome with the aid of the x-ray. Tuberculosis in all its forms, both internal and external, except in very advanced stages, is amenable to x-ray treatment when supplemented by other ordinary therapeutic measures.

While during the last two or three years nothing particularly new or startling has been announced in x-ray therapeutics there has been during this time a rapid and steady improvement in technique. Numerous failures in x-ray treatment have been reported, but in most of these cases in which the reports have been made with sufficient fullness of detail an expert can see in the mode of treatment itself good reasons for failure. It is not to be expected that a method which requires an

expert knowledge of electricity as well as of electro-therapeutics can be taken up at once without instruction and successfully used by the average physician. Besides the difficulties inherent in this form of treatment, we have to contend with a more or less widespread notion that any form of electrical treatment ought in some magic way to effect a cure by itself. When using electricity a physician frequently neglects the plainest indications for the use of drugs, or other remedial agents. The days of cure-alls have surely long gone by for physicians, and the electricity can and does advantageously displace many of the older forms of treatment it ought to be used only in those cases in which its effects are desirable. When so used, intelligently and in combination with such other means as may be required, it is without doubt the most valuable therapeutic agent in our armamentarium.

### Extraordinary Phenomena of N-Rays.

The latest of the various types of radiations discovered and studied during recent years—namely, the n-rays and the n<sup>1</sup>-rays—have developed most peculiar properties, some of which perhaps are capable of being utilized for practical purposes. Thus it has been found that certain chemical reactions are always accompanied by the emission of n-rays, while in other reactions, which from a chemical point of view are very similar, no n-rays appear. There appears to be no parallelism whatever between the process activity of the chemical reaction and the n-ray effect, and for this reason a study of the emission of n-rays might enable one to recognize the existence of a certain reaction otherwise masked. Some very interesting biological effects have recently been studied by several French savants with reference more particularly to the variation in the

emission of n-rays from the brain of an animal while under narcosis, and to analogous experiments with inanimate substances, like metals. For example, M. Edouard Meyer has found that plants cease emitting n-rays when subjected to the influence of chloroform; and M. Jean Becquerel later found that the same effect may be observed with inorganic sources of n-rays, like calcium sulfid, which, when exposed to vapors of chloroform or ether, cease entirely to emit n-rays.

The question having presented itself, What would be the effect on the nerve centers of animals under the influence of anesthetics? some experiments along this line were made by MM. Jean Becquerel and André Broca and reported to the French Academy of Sciences on May 24. They subjected dogs to the action of vapors of ether and chloroform and studied the

emission of n-rays from the brain substance and from the spinal marrow during the several stages of the experiment. The different narcotic substances have somewhat different effects in detail, but in general the effect is as follows: In the state of high excitement which precedes the stage of narcosis, the brain emits n-rays in enormous quantities. They may be easily observed by means of the decreasing brightness of a calcium sulfid screen, fixed at the end of a lead tube and passed over the brain fissure. When the subject reaches the real stage of narcosis, the phenomena change, the brain no longer emits n-rays and later on n<sup>1</sup>-rays appear. The latter are recognized from the fact that the brightness of the sensitive screen, when handled in the same way as before, now increases. It was found that the radiation from the spinal marrow undergoes much smaller variations than that from the brain. The spinal marrow can be studied with great ease on account of the centers of radioactivity existing in it, as located recently by Broca and Zimmern. Here the changes in the emission of n-rays are small, and even after respiration and the activity of the heart have ceased, the rays continue to be emitted from the spinal marrow for about half an hour. The absolute cessation of radiation from the nerve centers for several minutes is a sure sign of death.

In a later note presented by M. Jean Becquerel to the French Academy, other and still more singular observations are recorded. Aluminum and copper are transparent to n-rays, but this transparency ceases as soon as the surface of the metals is subjected to the action of anesthetics. On the other hand, glass and wood continue to let the rays pass. Moreover, a metal emitting rays from its total mass, like steel or copper in compressed or elongated condition, ceases emitting

rays if its surface is subjected to the influence of anesthetics, while compressed wood does not seem sensible to the action of chloroform or ether. All these facts emphasize the great complexity of the phenomena. Whether, however, the results observed are due to the anesthetic properties of the liquids used, or to other properties they possess, the report referred to leaves us in doubt. Before it can be safely assumed that inanimate substances are affected by anesthetics as such, very positive proof will have to be presented. M. Becquerel has attempted to analyze the nature of the molecular vibrations to which he attributed the origin of n-rays and n<sup>1</sup>-rays. He distinguishes two different vibrations: First, undulations like those of light waves, which pass through aluminum with a speed comparable with that of light through glass; second, another form of energy which passes through aluminum very slowly and the transmission of which may be arrested at the surface of metals under the influence of anesthetics.

Further investigation of these extraordinary phenomena will be awaited with interest. The history of the development of our knowledge of radiations is most interesting and peculiar in several respects. It is peculiar that the different kinds of radiation, some of which we now know to be nearly everywhere present, have been overlooked until quite recently, and their intimate study appears likely to remove some of the distinctions between different branches of science, while practical applications of their properties have already been made. We know, for example, that Röntgen rays are useful in medicine and surgery, and radioactivity has recently been applied to the measurement of capacities. Moreover, nothing has contributed more to the development of the electron hypothesis than the study of cathodic

rays, and it is not improbable that further investigation will furnish material for a wholly new foundation for the sciences of physics and chemistry. Even more interesting is that, in view of the results from the study of n-rays, we may at least hope that bridging the gap between animate and inanimate nature will not forever remain a mere dream of the speculative mind.—*Electrical World and Engineer*.

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**N-Rays.**—Bichat gives an account of experiments made to find an explanation for the apparent anomaly that n-rays, being a form of radiation, may be "conducted" by a wire. The conduction is a case of successive reflection. Light may be similarly conducted along a curved glass tube. The transmission is really due to the wire and not to the medium in which it is placed. In order that the conduction may take place, it is necessary that the material of the wire should itself transmit n-rays.—*Comptes Rendus*, February 8.

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**N-Rays.**—Bichat has observed some properties of n-ray emission which show a strict analogy to phosphorescence. Meyer has made further experiments confirming Becquerel's observation that there is a true action of anesthetics, such as chloroform, upon the emission of n<sup>1</sup>-rays. J. Becquerel has found that in all cases where a surface emits n-rays normally, it emits

n<sup>1</sup>-rays tangentially and vice versa. This fact establishes a close correspondence between the emission and absorption of these rays which leads him to some generalizations. A brick exposed to the sun emits n-rays normally and n<sup>1</sup>-rays tangentially. A patch or cross of the phosphorescent sulfid alternately brightens and darkens as successive surfaces of the brick are exposed to it. When a body is compressed, it emits n-rays from the compressed surface and n<sup>1</sup>-rays from the surfaces perpendicular to it. The author lays down the following general rules: The rays produced by the compression of a body (n-rays) have the property of increasing the sensibility of vision, and produce, on a surface capable of storing them, the same effect as regards radiation as does a compression normal to that surface. The rays produced by the stretching of a body (n<sup>1</sup>-rays) have the property of diminishing the sensibility of vision, and produce on a surface capable of storing them the same effect as a tension normal to that surface. The author seeks the origin of the rays in the vibrations of the molecules attaining a new position of equilibrium. In looking for some regularity in the spectrum of the rays, he found that Blondlot's values may be arranged in two series, one of them containing multiples of 2.9  $\mu\mu$ , the other containing simple fractional multiples of 4.9  $\mu\mu$ .—*Comptes Rendus*, May 30; (*Elec. World and Eng.*).





## Electricity in Diseases of the Throat.

BY H. L. LEWIS, M. D., CHICAGO.

Electricity as an adjunct in the treatment of diseases of the throat is practically limited to galvanism and faradism, applied either internally directly to the membranes of the larynx by a laryngeal electrode or externally to the neck by the ordinary flat sponge electrode.

The application of either the positive or negative electrode directly to the vocal cords in some forms of paralysis is probably more efficacious in restoring the voice than the external or general application, but it is also much more disagreeable to the patient and is often harmful. The direct application of the electrode to the muscles of the larynx is quite a difficult and delicate procedure, requiring considerable practice, as the least bungling or roughness will set up a spasm of the pharynx and glottis and prevent a successful application.

With a suitable laryngeal electrode, in which the current may be instantly turned on and off by pressing a button, as soon as the tip is seen in the laryngeal mirror to be in position upon the vocal cords a succession of short, rapid shocks may be passed thru the larynx. This should be done three or four times at each sitting.

Generally the electrode is kept in the larynx for three or four seconds each time it is introduced. The opposite pole should be placed low down on the neck over the cricoid cartilage. While the internal electrization requires especial skill in handling the electrode, the external method is much more easily performed by the operator and is within the reach of any physician who understands the galvanic or faradic current and its ordinary application. The external application of electricity is also more agreeable to the

patient and in the greater number of cases will give more beneficial results.

In the few cases in which it fails to give quick results the internal application directly to the parts may be resorted to, but it is advisable always to try the most agreeable method for the patient first, even in those cases which have persisted for several months.

The external application of the faradic current for from two to five minutes is of benefit in the treatment of nearly all inflamed and irritable conditions of the throat, and when continued for some time exerts a tonic influence on the larynx.

Electrical treatments are especially beneficial in functional diseases of the larynx associated with hysteria or anemia, and should always be resorted to early in this class of cases. All local treatment is very much aided by general electrization by means of a mild static breeze or by a general application to the throat of a high-frequency current. Subacute and chronic irritations of the larynx and pharynx are also much benefited by this method of electrization in addition to suitable sprays and local applications directly to the diseased surface.

In aphonia electricity is of the greatest service.

To intelligently apply the proper electrical treatment it is necessary to have a definite knowledge of the general nature of the lesion and to appreciate the exact pathological conditions in each case.

Above all it is necessary to determine whether the symptoms are of an organic or of a functional character. Mackenzie adopted the following classification of paralyzes of the muscles of the larynx, which one should bear in mind:

- (1) Bilateral paralysis of the adductors.
- (2) Unilateral paralysis of the adductors.
- (3) Bilateral paralysis of the abductors.
- (4) Unilateral paralysis of the abductors.
- (5) Paralysis of the tensors.
- (6) Paralysis of the laxors.

Bilateral paralysis of the adductors is most frequently due to hysteria and debility or fatigue, and is but a local manifestation of some constitutional disorder. It yields quickly to general as well as local electrical treatment.

Unilateral paralysis of the adductor may be not only due to phthisis, but is usually due to some toxic poisoning, to syphilis, to cold and to cerebral disease, and is naturally more persistent than bilateral paralysis. Bilateral paralysis of the abductors is usually due to some central difficulty and is more serious and less amenable to treatment. Unilateral paralysis of an abductor, while due to the same general cause as the bilateral paralysis, is more often excited by some peripheral irritation, as pressure on the recurrent or pneumogastric nerve by an aneurism or enlarged gland and is equally unfavorable to treatment. Paralysis of the tensors and laxors, either unilateral or bilateral, results in the majority of cases from too prolonged or violent use of the voice and is quite amenable to electrical treatment. All nervous affections of the throat, such as spasm of the glottis (laryngismus stridulus), anesthesia and hyperesthesia of the larynx, and nervous cough may be much benefited by the external application to the neck of fifteen to twenty milliamperes of the galvanic current, the anode to the back of the neck, the cathode to the throat.

#### Continuous Electrical Service.

President Charles W. Eliot, of Harvard University, made a notable and profound address on labor problems before the Central Labor Union at Faneuil Hall, Boston, on the evening of February 7, at which, among other truths, he recognized the necessity of absolutely constant and continuous electrical service for light, telegraph and telephone, as being necessities of life.

He said:

People can wait for cigars or cash registers, or even for houses and shops; but they can not wait long for food, or domestic fuel, or, in cities, for the water which must be pumped by coal, or for the street lights produced by coal. Already in the United States the supplies of these necessities of life in modern society have been seriously threatened, and indeed, for brief periods, partly cut off.

From such dangers society must find a sure way to defend itself. The total interruption of the postoffice, telegraph or telephone service, or municipal water supplies is not to be contemplated by modern society. Other modes than strikes or lock-outs must be used for adjusting wages and hours of labor in such services as these.—*El. Review*.

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#### The Electrochemical Equivalent of Silver.

Various careful attempts to determine the electrochemical equivalent of silver give values varying from 0.011156, as determined by Mascart, to 0.011195, that found by Pellat and Ledue. A determination made by G. Van Dijk and J. Kunst gives as a mean value of twenty-four measurements, 0.0111818, a value which the authors believe to be accurate within one part in 10,000.—*El. Review*.

# EDITORIAL

The American Electro Medical Society will hold its second annual meeting at Chicago early in December.

We regret to learn of the death of the wife of Dr. John T. Pitkin, of Buffalo, July 20th, at her home, and tender our sincere sympathy to Dr. Pitkin, who has a warm place in the hearts of all electro-therapeutists.

Professor Goldsborough, whose face adorns this issue, is exhibiting the amount and variety of energy that his friends expected from him in pushing the electrical department of the World's Fair. His strong personality and well known ability as an electrician have contributed not a little to his marked success in this task.

## St. Louis Meetings.

The International Electrical Congress meets at St. Louis from the 12th to the 17th of September. Simultaneous conventions and joint sessions will be held by the American Institute of Electrical Engineers, the American Electrochemical Society, the American Physical Society, the American Electrotherapeutic Association, the Association of Municipal Electricians, and some others.

The American Roentgen Ray Society meets Sept. 8 to 13 at St. Louis.

**Fourth Pan-American Medical Congress**—The next meeting of the Pan-American Congress will be held in Panama the latter part of December.

The Pan-American Congress meets every three years. It was started by Dr. William Pepper of Philadelphia, Dr. C. A. L. Reed of Cincinnati, Dr. Albert Vander Veer of Albany, and Dr. H. L. E.

Johnson of Washington. The first meeting was held in Washington in September, 1893, the second in Mexico in 1896. The third was to have been held in Venezuela in 1899, but was given up on account of the war in that country. The place of meeting was changed to Cuba, but had to be postponed until 1901 on account of the fever there.

These meetings have always been well attended and it is thought that Panama will be an interesting place for the convention.

Further particulars will be sent out from time to time to the Journals, together with notifications of the different officers appointed to represent this and other countries.

RAMON GUITERAS,  
Secretary of the International Executive Committee.

## Special Offer to New Subscribers.

During the next four months new subscribers to the AMERICAN X-RAY JOURNAL can get the JOURNAL for one year for only *one dollar*; to those living in Chicago or in foreign countries the price is a dollar and a half. Old subscribers whose subscriptions are paid in advance will receive a time credit which will give them an equal advantage.

We believe that there are a large number of physicians who want this JOURNAL and who will be glad to pay the regular subscription price as soon as they read it and realize its value. Everybody interested in progressive therapeutics ought to read it for the condensed news of the latest methods and results. It covers the whole field of therapeutics except surgery and drug medication.



## Electro-Therapy.

A Course of Twenty-four Lessons under the auspices of the Chicago College of X-Ray and Electro-Therapeutics.

Lesson 13—REFLEXES.—By T. Proctor Hall, Ph. D., M. D.

When a stimulus of any kind applied to a living body results in some activity of that body, the action is said to be reflex. It is understood that in such cases the energy of the action comes from the body, and that the stimulus acts in the same way as a spark to powder, or as touching the trigger of a gun. Of these reflex actions there are two varieties, direct or muscular, which are independent of the central nervous system and are produced by mechanical or other stimuli applied directly to the muscles; and sensory, which are produced by a stimulus acting first thru a sense organ, proceeding thence to the central cells, and giving rise to a motor impulse from that point.

The direct or muscular reflexes are used therapeutically in developing the muscles or in preventing degeneration in cases of serious interference with the normal nerve stimulus. The therapeutics of this kind of reflex is consequently very simple. Either the faradic current or the interrupted galvanic current, or both, may be employed for this purpose.

The condition of a muscle with regard to degeneration may be inferred from its reactions to the faradic and galvanic currents. Electro diagnosis is important in some cases in order to enable a correct prognosis to be made. But in nearly all cases for therapeutic purposes a rough determination of the ability of the muscle to respond to electric and mechanical stimuli is all that is required. If any muscular power is left there is hope of improvement. If the muscular response is good the question of cure depends upon the condition of the nervous system. Given abundant nutrition and either

natural or artificial exercise under fairly normal conditions and the muscular power will at any rate not decrease.

The muscular reflexes are measured by the amount of current which is required to cause a perceptible contraction when the current is suddenly started or stopped. A milliamperemeter is required, a rheostat for increasing or diminishing the current gradually, and a make-and-break apparatus. The latter may be done by hand. The points at which the nerve is close to the surface are known as motor points. The current applied at these points causes contractions much more readily than when applied elsewhere.

Dr. Clevenger has proposed a simple nomenclature for these diagnostic reflexes. The letters K C stand for kathodal closing and A C for anodal closing. Added to each of these is a figure denoting the number of milliamperes required to produce contraction. The formula K C 1 indicates that when the kathode is on the motor point of that muscle one milliamperemeter is required to cause contraction. For ordinary muscles in normal condition one or two milliamperes is sufficient. For the anodal closing a little more current is required to produce contraction, two or three milliamperes being the average. There is considerable variation in these numbers even in health, but the K C is always less than the A C. In most conditions of muscular degeneration, tho not in all, these numbers are reversed, the K C requiring a greater current than the A C. Other reactions are the anodal opening and the kathodal opening, which are designated in a similar way but which are of very little practical importance.

The nervous system is included in two main divisions, the voluntary or conscious brain with its accompanying motor and sensory nerves, and the "sympathetic system." In reality only a small part of the voluntary nervous system is directly concerned with consciousness. But it is the machinery by which we come into relation to the outside world. The involuntary system is concerned with the internal conditions of the organism. Its operations are entirely unconscious. Its actions are slower, and it does not respond directly to our will. A large part of the unconscious operation of the voluntary nervous system is more expressively termed sub-conscious. Of all the sensations which reach us we are fully conscious of a very few; many of the rest are stored away in the central nervous system to be consciously or unconsciously revived later. Others never reach the threshold of consciousness, but produce reflex actions which are necessary to our normal existence. The whole field of sensation is aptly compared to the solar spectrum. The comparatively small field of consciousness corresponds to the visible part of the spectrum of the body, causing the ordinary "tone" containing the colors of the rainbow, and the sub-conscious regions correspond to the much larger invisible spectrum consisting of the infra-red and ultra-violet rays.

For therapeutic purposes it is not necessary to draw a distinction between the conscious and the sub-conscious reflexes

since they all follow the same law. Very mild sensations, either from without or from within, which are usually sub-conscious, act upon the central nervous system and upon the ganglia in various parts of the body causing the ordinary "tone" or normal contraction of muscular and other tissues, glandular activity, etc. In case of weakness or injury these reflexes may fail at some point. If the failure is marked there will be relaxation of the muscular coats of the smaller blood vessels, causing hyperemia, with possible exudation of the serum, and perhaps diapedesis—the various stages of inflammation. In such cases a slight increase in the normal stimulus may be sufficient to restore the muscular tone and remove all signs of inflammation. Brushing the skin with a soft brush or feather, or passing the fingers lightly and repeatedly over it, or tapping with a light stick, or spraying with static electricity, or any other method which increases very slightly the normal reflex, is sufficient to restore the normal conditions.

When the sensations are made much stronger so as to approach the painful the reflex is prevented thru temporary exhaustion of the nerve cells. This results in hyperemia, and painful applications of any form produce this result. Excessive sensations may temporarily paralyze so much of the central nervous system as to relax all the blood vessels and cause the condition known as "shock."



### Proposed Experiments with X-Ray and Radium.

BY EDWARD P. THOMPSON.

Before the advent of Röntgen rays Sir John Lubbock, F. R. S., proved, by a long series of critical, varied and repeated experiments, that the invisible ultra violet rays are perceived, in some manner or other, by the insignificant yet highly interesting ant. For details of the apparatus and experiments see "Ants, Bees and Wasps," D. Appleton & Co., published in 1888. His experiments were based upon the dislike which ants, in their nests, have for light. Although they have no such feeling when out in search of food, yet if light is admitted to their nest they at once hurry about in search of dark corners, where they all congregate. If, for example, he uncovered one of the nests and then placed an opaque substance over one portion, the ants invariably made the shaded portion their rendezvous. The ants likewise carried their pupæ and larvæ to the darkest portions of the nest. This characteristic was also the basis of operations.

His first experiments related to the ants, relative avoidance of visible light rays of different colors. In all these tests the violet and purple rays affected the ants much more strongly than the other colors employed. In a general sense the transmitted light of differently colored glasses appeared to act on ants in the same general order as it does on a photographic plate. Furthermore, they preferred the violet glass to the plain, colorless glasses. In place of the latter solutions were tried, and tests involving equal temperatures were included, but the results remained the same. It is needless to say that Sir John Lubbock took every possible precaution and followed the strictest rules of scientific research.

Another series of experiments includ-

ed ultra violet rays, negatively. He had found that if the ants have to choose between the violet and other colored glasses they always preferred one of the latter. Next he found that the effect of putting over the violet glass a layer of either of sulfate of quinin or bisulfid of carbon (both of which are transparent to our eyes, but both of which cut off the ultra violet rays), the effect was to make the violet glass seem to the ants as good a shelter as any of the other colors. Hence this two-fold result is strong evidence that ants perceive ultra-violet rays.

He then tried more positive experiments with a saturated solution of chrome alum and chromium chlorid, as these are very opaque to the visible light rays, but transmit the ultra violet rays. The results were very striking. It made that portion of their nest so dark that he could see nothing. By an apparent expedient for watching their movements he found that the ants avoided the ultra violet rays. Different species of ants and different ants of the same species but of different nests behaved in a similar manner.

Whether the ants actually see some new color or light, or feel or hear it, is not certainly known: but that ants constitute a detector of the invisible portion of the spectrum beyond the violet appears conclusive to Sir John Lubbock.

I have no longer the facilities for making x-ray experiments, nor do I know if others have tested their effect upon ants, but I propose to the Carnegie Institution at Washington or to others who are experimenting in the field of ether vibrations or limits of vision in animals to determine if ants are affected by x-rays.

The electrical engineer is not so much concerned about the physiology of ants as is the naturalist, but he is anxious to add more facts for assisting in arriving at



a more exact knowledge of the nature of x-rays. So far, it is known that this form of radiant energy causes certain salts to fluoresce, and that it affects the photographic plate. Consequently it is like the short wave length from a luminous source. It is at the same time invisible to man, and is thus like either the very short or very long wave length. It is like a long wave length in its power of penetrating substances which are opaque to light. As the same wave could not be both long and short at the same time, there is no reason why it could not be a mixture of long and short waves or else some energy without waves. Until ants are experimented upon, therefore, there is a void in this department of the science of radiant energy. A short wave, or energy of the spectrum beyond the violet, trouble ants. Will these insects immediately run away from Röntgen rays?

Investigations should also include the recently discovered etheric radiations. As nine years have elapsed since Professor Röntgen made his remarkable discovery, and although all conceivable tests have been made upon radiant energy, may we not, perhaps, say, "Go to the ant, thou sluggard; consider her ways and be wise"?—*Elec. World and Eng.*

#### Electricity and Life.

Years ago, when making researches in this line, I found an animal to be opaque to electrical waves when living, and transparent to these waves after death. Since then I have discovered that the opaqueness of the body of a live animal to electrical undulations is due to the fact that every muscle and nerve in the body is electrically active during life, and is, in fact, a bundle of electrical currents, and, consequently, electric waves can not get through them. At death these electric activities cease and the

electric waves can pass through the body and make their impression on the recording screen on the other side. This shows how closely electricity is connected with life, and suggests a method of testing whether life is extinct or not; and prepares the way for other experiments. Moreover, it is a possible new mode of diagnosis, because the different parts of the body will be unequally transparent to electric waves according as they have unequal amounts of electric activity in them, as they would be likely to have under pathologic conditions. But the most important result of the experiment is this: It led to the discovery that living things give off electric waves [also "n" rays, as shown by Blondlot] in proportion to the degree of mental activity, which makes it possible to quantitatively measure conscious states. This opens a new field of research in scientific psychology—that of measuring subjective states and comparing them with each other in the same person or in different persons.

The apparatus by which the above experiment can be most easily repeated consists of an electric spark oscillator capable of giving off electric waves varying in pitch up to the highest frequency attainable—a modified form of such apparatus as is now used in wireless telegraphy—and instead of a coherer use a set of coils for transforming the electric waves into electricity so that it may be measured by a delicate reflecting galvanoscope. These wire coils must be small enough to be hidden behind the body of the animal, so as to be in the shadow with reference to the source of electric waves. If the apparatus is sufficiently delicate it will measure the waves which pass through the body of an animal after death, but will not indicate them when

the body is alive. The apparatus becomes more delicate if along with the electric waves there are projected ultra violet waves of light—which are also electric undulations, because of an action similar in discharging a static condenser they likewise act upon the coil.—*Prof. Elmer E. Gates, in Suggestion.*

**Death From Electric Shock.**—Jel-linek's recent experimental researches show that various kinds of animals have different reactions against the influence of electric currents. Horses are killed by the electric current in street cables—i. e., a constant current of 460 volts—while unipolar application of constant current of 110 volts has a bad effect after a time. Small animals, such as rabbits, dogs and guinea-pigs, are more resistant, while frogs and tortoises are not killed by currents of 10,000 volts. Death occurs through paralysis of the heart and respiration, and animals which recover show similar symptoms to those which occur in man after lightning stroke, such as paralysis, coming on after an interval sometimes, hemorrhages, and ocular lesions. The injury to human subjects through electricity depends not only upon the tension and amount of the current, but, and in particular, upon the re-elongation of the heart.—*Ex.*

#### Glimpses of Steinmetz.

In the June *World's Work* Arthur Goodrich tells some interesting stories about Mr. Charles P. Steinmetz, chief engineer of the General Electric Company at Schenectady. "One of his ablest assistants spent a number of days of hard work in solving an intricate mathematical problem. When he had finished it he asked Steinmetz to work it out. The inventor grasped the problem at once, counted on his fingers a few times, and gave the cor-

rect answer without touching pencil or paper. Yet he remarked recently: 'Mathematics is valuable only to obtain results. Mathematics for mathematics' sake is foolishness.'

"Some years ago Steinmetz went into the Adirondaeks with a hunting party of friends. Not caring to hunt, he was often left alone at a little lodge that was made the party's headquarters. One night before the camp fire a mathematical question came into his head. To settle it he needed a table of logarithms which could not have been found within miles of the camp. He remembered a few figures, and in a short time had worked out an entire table of logarithms for himself, and from it solved the problem. This mathematical sense, which was originally trained by hard study at Breslau, makes it possible for him to answer quickly the rapid fire of questions his aids hurl at him daily.

"The laboratory workers come to him constantly for advice and direction. Eighteen thousand employes stand ready to work out his ideas. With the men he is always genial and democratic. When any business matter needs settling he does it in determined fashion. He is as independent as he is good-natured. When the heads of the works made a rule against smoking in the factory. Mr. Steinmetz said he would smoke or leave. He did not leave. 'He can accomplish more in an hour,' said one of his assistants, 'than I can do in a week.' If some difficult problem needs solution at the works, it is nearly always taken to Steinmetz.

"Not long ago there was an explosion in a manhole in New York City, which made great trouble for an electric railroad. Many local engineers tried to find out the cause of the trouble, and gave various unsatisfactory explanations. The matter was brought to Mr. Steinmetz's attention. In

a few moments he asked how certain adjacent wires in the manhole were covered. Here, indeed, was the trouble. It was simple, but no one else had thought of it. He takes the short cut to the essential thing. It is characteristic of all his work."—*Electrical World and Engineer*.

#### **Otto Schmidt's Treatment of Cancer.**

Ours is not the only public infested by the octopus called "quack." John Shaw (*Medical Press*, March 16, 1904) states that while journeying in Switzerland he took occasion to study, at one month's interval, the effect of this widely advertised treatment on some of his countrymen and women who had been seduced into taking it. It is the same old story of injections, promised cures, sloughings, delays and ultimate recurrences. The author was unable to obtain any satisfaction from Dr. Schmidt, and when he remarked that a certain patient, who was about to be discharged "with the cancerous process arrested," be sent to Professor Von Bergmann in order that his opinion as to the alleged arrest might be obtained, Schmidt replied: "Es hat keinen Zweck." In the opinion of the author it is desirable that before any further exodus of English people takes place to this sanitarium it should be further investigated.—*Medical News*.

#### **Professor Rutherford on Radium.**

No man has done more than Professor Rutherford to elucidate the nature of the processes going on in radio-active substances. His highly original and delicate experiments, and his masterly analysis of the evidence provided by these experiments, have revolutionized our ideas of molecular and atomic physics, and revealed to us the existence in matter of an unsuspected source of energy. It is not to be wondered at, therefore, that his lecture at the Royal Institution on the 20th

ult. attracted a crowded and brilliant audience. So great has been the interest in radium, and so much has been published about it in technical and other journals, that it was difficult even for Professor Rutherford to tell us anything new. The emanation from radium received special attention in the lecture. The lecturer stated that the emanation, though exceedingly minute in quantity, contained three-quarters of the whole energy of radium. If we could collect a cubic inch of the emanation, the tube which contained it would probably melt, while a few pounds of the emanation would supply enough energy to drive a ship across the Atlantic. The energy of the emanation does not last very long, since it falls to about half its original value in four days. Recent discoveries point to the conclusion that radium is widely distributed through the substance of the earth. The emanation has been found in the discharge of deep springs, in volcanic mud, and in clay soils in many parts of the earth's surface. This suggests the theory that the internal heat of the earth is due to radium, and if this be true it must lead to an important modification in the period calculated for the age of the earth by Lord Kelvin. Nothing could better illustrate the immense increase in the resources of scientific research than the rapid development of the apparently insignificant experiments of Becquerel into the present far-reaching theory of radio-activity.—*London Electrical Review*.

**Hot Air Treatment.**—Dr. De Lancey Rochester, of Buffalo, said that even without the cumbersome hot-air apparatus it is possible to obtain good results in the treatment of arthritis deformans. Hot-air baths may be given in bed by means of a spirit lamp, and if followed by friction of the skin, relaxation need not be feared.



Massage, careful passive movements will also be found of service. The affection occurs not infrequently in stout people and in these particularly sweats and massage are likely to be of service. The regulation of diet should exclude sweets and not much starch should be allowed. Fresh green vegetables, which contain organic iron in a form readily available by the system should be freely used. Where there is any tendency to constipation, salines should be given.—*J. A. M. A.*

#### Two Cases of Severe X-Ray Necrosis.

Clarence E. Skinner reports two cases of severe x-ray necrosis presenting some unusual features. The history of these cases is interesting, but a perusal of the author's conclusions is of value, especially to those who are entering upon the field of x-ray work. They are as follows:

First, the belief, somewhat extensively held, that a patient who "tans" well need not fear a burn, is demonstrated by these cases to be untenable. Both of these patients tanned readily and profoundly.

Second, the "tanning" and excessive epithelial proliferation of the new skin observed in Case I, and the profound erythema and structural changes of the new skin observed in Case II, all of which modifications obtained in tissues which had developed months after exposures to the rays had ceased, indicate that the physiological action of the x-light is not confined to stimulant or destructive influence upon tissues that already exist, but that it is capable of modifying most profoundly, and more or less permanently, the developmental functions which control cell growth. I have previously expressed a belief in this phase of influence, and that we shall ultimately find that it plays no small part in the beneficial effect exerted by the x-ray upon many cases of malignant growths.

Third, the abrupt cessation of the sharp, cutting pains simultaneously with the final separation of the necrotic tissue, would point to direct irritation by the sloughing mass, of the distal ends of nerve trunks supplying the affected parts as their exciting cause, probably through the development of toxins by retrograde tissue metamorphosis at the line of separation; a pure neuralgia in short, and which would indicate extirpation of the necrotic area by curettement or otherwise as a logical management for x-ray dermatitis of this degree.

Fourth, the accelerating influence of the direct electrical current upon the process of healing after the slough had separated, noted in both cases, is significant from a therapeutical standpoint. The power of the negative pole of the direct electrical current to hasten repair in open sores of various sorts has long been known to electrotherapeutics, but the x-ray ulceration has exhibited a peculiarly intense resistance to all ordinary measures available for this purpose, and the knowledge that we have in this modality an effective curative agent even in this condition constitutes a comfortable thought. It is probable that skin-grafting will be avoidable in many cases where galvanism is available.

Fifth, the appearance of new areas of necrosis, in Case I five months, and in Case II six months, after the last x-ray exposure had been made, admits of three hypotheses in the way of explanation. It might have been due to a cumulative characteristic of the ray, whereby the direct effect of the exposure did not fully develop until after these lapses of time: it may have been due to a modifying influence exerted by the ray upon the developmental functions of the cells involved, whereby the younger generation of cells were unable to acquire the degree of vitality necessary for the maintenance of

tissue integrity; or it may have been the indirect result of circulatory insufficiency caused by an x-ray endarteritis obliterans which had required this length of time for its full development. None of these are entirely satisfactory, however, and we shall have to await the acquisition of a fuller knowledge of the *modus operandi* of x-ray effects before we can decisively account for this, and many other of its vagaries.

Sixth, the sedative effect of anesthesine upon the pain in Case I, and its aggravating influence in Case II, illustrates the statement frequently made, and the truth of which is now pretty generally admitted, that no two cases of x-ray pain can be depended upon to react uniformly to the same palliative agents. "What's one man's meat is another man's poison." Each case must be treated according to its own individual peculiarities, and usually the only way to ascertain the peculiarities is to begin at one end of the list of therapeutic agencies and apply them successively until we find one that is effective.

Seventh, the sudden and constant appearance of subcutaneous hemorrhage preceding the development of necrosis noted in Case II is worthy of record, but I do not at present comprehend its significance, nor can I offer a satisfactory explanation.

In conclusion, the histories to date of these two cases constitute a warning against exposing a patient to the x-rays with even a moderate degree of frequency through long periods of time, no matter how well they seem to bear them at first. There are few conditions so pregnant with torture for the victim as a deep x-ray dermatitis, and the risk of precipitating such a disaster is only justifiable in cases presenting an absolutely hopeless prognosis under other methods of treatment.—*Medical Standard*.

### Some Unappreciated Uses of the X-Rays.

BY ALFRED L. GRAY, M. D., RICHMOND, VA.

It is not my intention in this brief paper to introduce into the realms of radio-therapy or radio-diagnosis any innovation, but merely to call the attention of the profession generally to some of the more unusual purposes to which the x-ray may be applied, that are fully as important and equally as valuable in the field of diagnosis as those of every day usage.

There are no means at our disposal, as is now well known by all of us, that can compare with the Roentgen rays in the diagnosis of diseased or injured bones, the location of foreign metallic bodies, calculi, etc. But how few of us make use of this most convenient and accurate method of determining the existence of certain pathological conditions in the soft structures? It is as a plea for the more frequent use of the rays for this purpose that this paper is intended.

There is scarcely one of the many serious diseases affecting the thoracic viscera concerning which the skilled employment of the x-ray does not furnish additional valuable information. Many pathological conditions existing within the abdomen and its walls may also be accurately diagnosed by this means.

Probably the value of the x-ray in the diagnosis of thoracic aneurism is the most widely appreciated of the uses to which it is my desire especially to call attention. The importance of this means of diagnosis of this often, most obscure and sometimes otherwise undeterminable condition, can not be too strongly emphasized.

The frequency of the existence of this disease is far greater than is generally believed, and often will it be found that prolonged hoarseness, intractable coughs believed to be due to chronic bronchitis, and many other chest symptoms are in

reality due to the presence of thoracic aneurism. Within the past six months I have discovered aneurism in five cases that were referred to me with no positive evidence of this condition existing.

The diagnosis is simple and unmistakable, and is best made with the fluoroscope, save in case of very small tumors, for the pulsations may be readily seen in this way, whereas the radiograph may not distinguish this from other tumors within the thorax.

The second use to which I would call attention is in diseases of the lung. By means of the radiograph, areas of consolidation too small and deep-seated to be detected by a physical examination, may be readily demonstrated and thus a circumscribed pneumonia or beginning phthisis may be diagnosed. By comparison of radiographs taken from time to time we may watch the progress of the disease and may note any increase or diminution of the diseased area.

Cavities may be readily detected and located and the presence or absence of an abscess ascertained.

The radiograph will easily demonstrate pleuritic effusion, empyema or pneumothorax. Hypertrophy and dilatation of the different chambers of the heart may be plainly shown, and in some instances atheroma of the aorta has been found.

Much valuable information may likewise be obtained from examination by the rays of the abdominal contents, though this is usually much less satisfactory than chest work.

Abscesses of the liver and other abdominal viscera, if they are of considerable magnitude, may readily be shown. By a radiograph alone I was enabled to discover a case of atrophic cirrhosis of the liver, and subsequent clinical evidence verified my diagnosis.

Splenic enlargement and, in some in-

stances, hypertrophy of the kidney can be detected.

It is claimed by some radiographers that they have, with the latest improved apparatus, been able, by short exposure, to photograph not only the normal kidney but also the pancreas. I have not succeeded in obtaining a satisfactory picture of either of these organs when normal.

Abdominal and pelvic tumors may often be found and their nature practically ascertained.

Still another fact that may be of inestimable value is that coagulated blood is more or less opaque to the rays. By reason of this we may not infrequently locate an intra-cranial clot, thus enabling the surgeon to proceed with its removal with certainty as to its whereabouts.

I have recently made some exceedingly interesting radiographs of the roots of teeth in their sockets, showing their shape and condition, a correct knowledge of which is essential, especially in dental prosthesis.—*Virginia Semi-Monthly*.

---

**The Roentgen Ray in the Treatment of Leukemia.**—W. J. Taylor, in the *Cincinnati Lancet-Clinic* of May 14, 1904, describes the case of an unmarried woman twenty-four years old. The patient had never been robust, though her health had been fair up to her twentieth year. Two years before coming under observation there was a noticeable enlargement in the upper left quadrant of the abdomen accompanied with a feeling of fullness, distress, and pain. There was a daily rise in temperature, and the diagnosis of malaria was made. In October, 1903, there was marked enlargement of the spleen; the lower border was down to the left ileum and extended one and one-half inches to the left of the umbilicus. There was a well defined notch in the anterior border. The skin and mucous mem-



branc were pale and of a muddy color. Emaciation was extreme, and there was persistent digestive disturbance. For months the diarrhea had been almost uncontrollable, and vomiting was a troublesome feature. The slightest exertion brought on dyspnea and faintness. There was no tenderness of the bones or joints. The blood examination showed 1,575,000 red cells, 147,000 leucocytes, and hemoglobin 24 per cent. Daily x-ray treatments over the region of the spleen were begun. On the third day vomiting stopped, and on the sixth day the patient gained control of her bowels. A blood-count a week after beginning the treatment showed an improvement. By the latter part of November the spleen had grown much smaller, the leucocytes had decreased to 7,480, and the hemoglobin had risen to 37 per cent. The spleen was scarcely palpable below the costal margins. In December the patient died of some complication, during which there were meningeal symptoms.—*Medicine*.

**A Case of Splenomyelogenous Leukemia Improved Under the Use of the Roentgen Ray.**—C. H. Weber (*American Medicine*, May 21, 1904) reports the case of a widow aged fifty-three years whose illness began with a pain in the splenic region. The pain was sharp and shooting, and was increased on pressure or deep inspiration. The diagnosis of pleurisy was made. Shortly after this attack she observed that the abdomen was enlarging and that deep inspiration was difficult. There was loss of appetite and continuous headache. At the time of admission the patient was fairly well nourished, though she had lost flesh for several months. The complexion was clay-colored, the spleen extended a fingerbreadth to the right of the median line and below to within an inch of the crest of the ilium.

The urinary examination was negative. The red blood-corpuscles numbered 2,100,000, the white blood-corpuscles 328,000, hemoglobin 30 per cent. The patient was under observation for a period of less than six months, during which time there was a steady improvement in her general condition. For the last five months of this period she received no medication, only the Roentgen rays. There was no fluctuation in the blood-counts, but a steady improvement and a gradual extinction of the myelocytes. The final blood-count showed 4,720,000 reds, 7,200 whites, and hemoglobin 72 per cent. The subjective conditions all improved, and the blood findings at the end were normal.—*Medicine*.

**Common Sense and Radium.**—The *Medical Record* of May 14, 1904, in an editorial says that the real and alleged properties of radium seem to have overturned the reasoning faculties of a large portion of the public and some of the medical men. Statements are constantly advanced as to the marvelous events that can and will be brought about through the influence of radium. A French scientist has affirmed recently that the heat rays of radium are capable of melting stones and disintegrating, with great celerity, iron and steel, so that the effects of the rays will destroy fortifications, crumble battle-ships and will extinguish human life like dew before the morning sun, thus rendering warfare impossible. Commenting upon these claims A. F. Collins, in the *New York Times* of May 8, says that radium can not compete with ultraviolet light in its healing properties. There are no diseases for which the x-ray or ultraviolet radiations are not superior and do the work quicker and better than radium. A grain of radium having a radioactivity of 20,000 costs \$1,250, consequently few

physicians possess the substance in such activity, must use those of 1,000, 3,000 or 7,000. These exercise a very slight effect upon malignant growths.—*Medicine.*

### **An Experimental Research on Radium, Radioactive Substances, and Aluminum**

—M. Metzenbaum (*Cleveland Medical Journal*, May, 1904) gives some interesting observations along the lines of investigation marked out by Becquerel. A piece of Bohemian pitchblende placed on a bare photographic plate produced its own image and affected the plate for one-half inch from its border. The same piece of pitchblende placed on the reverse side of the photographic plate covered with black paper and allowed to remain five days not only affected the plate under the object, but for three-quarters of an inch from its circumference. A hermetically sealed tube of very thick glass containing five grains of pure metallic uranium was placed on a photographic plate covered with black paper. After 120 hours it gave a deep print of itself. From these and somewhat similar experiments with uranium the writer forms the conclusion that the various uranium salts are capable of affecting a photographic plate, and that these rays can penetrate black paper, aluminum, bone, and glass, and that they act at a distance of several inches. At a distance of one inch it requires about twice the length of time for the rays to act as compared with their effect when only separated from the photographic plate by black paper. After several months uranium salts have lost none of their radioactivity. The experiments performed with thorium were the exact duplicates performed with uranium. The results were the same, excepting that the action on the photographic plate was

prompter. Zirconium was found even more radioactive than thorium.—*Medicine.*

### **Pruritis Ani Treated by X-Rays—Pen-**

nington (*New York Medical Journal and Philadelphia Medical Journal*, February 20, 1904) reports thirteen cases of pruritis ani treated by exposure to the x-ray. Most of the cases were cured, and though still under treatment, all improved. In none of the cases has there been produced a dermatitis, or any other ill effect. The skin is left smooth, soft, clean and pliable. While there is no objection to the use of other procedures in conjunction with the x-ray, yet none were employed in these cases, and the results have been so similar and constant in all of them that they are undoubtedly due to the action of the Roentgen ray.

### **Photographic Action of Radium Rays.**

—Since a photographic plate by exposure to radium rays is affected in such a way that the plate develops similarly to its development after its exposure to light, Skinner has made experiments to find whether the actions are the same in both cases. His results seem to indicate that only slight differences occur in the early stages of development. For prolonged exposure he reaches the following conclusions: The density of the image produced on a plate by exposure to radium rays ( $\beta$  and  $\alpha$ ) increases to a critical value and then decreases, first rapidly and afterward very slowly, until a time is reached when the image is totally reversed. Spark images are at first obliterated by radium rays which do not cause such a great density as that of the spark images obliterated. With prolonged exposure, radium rays reverse spark images.—*Phil. Mag.*, March.

### The Results of X-Ray Treatment.—

Samuel Beresford Childs (*N. Y. Med. Jour.*, July 2) concludes from his own experience and that reported by others: First: The therapeutic field of greatest usefulness of the x-ray is with superficial epitheliomata, rodent ulcer, and lupus vulgaris, when the area involved is conspicuous, as on the face or neck, and where a cosmetic result is particularly to be desired. Second: Healing by the x-ray leaves the smallest and least perceptible scar; for, when properly applied, it destroys only diseased tissue, and particularly commends itself for use in those localities where it is undesirable to sacrifice the surrounding tissues. Third: The x-ray is very efficacious in many obstinate cases which have resisted the ordinary methods of treatment, such as acne rosacea, chronic localized patches of eczema and psoriasis, lupus erythematosus, and kindred skin diseases. Fourth: The results in tuberculous glands, when no suppurating focus is present, are encouraging and the enlarged mass of glands in Hodgkin's disease appear to be susceptible to the treatment. Fifth: The x-ray should not be employed in any operable, deep, malignant growth, with two exceptions: First: as pointed out by Coley, where a surgical operation would sacrifice an extremity, and even in this case the value of the x-ray is uncertain, and is determined by a few weeks' trial. Second, as mentioned by Pusey, with a view to limiting the operation by checking the growth when immediate operation is inadvisable. Sixth: The x-ray may be of service even in inoperable malignant growths, by relieving pain, diminishing discharges, and lessening their offensiveness, and in many cases life may be prolonged in comparative comfort for a considerable period of time. Furthermore, from these apparently hopeless cases a number of remarkable

improvements and a few recoveries have been reported. Seventh: The x-ray should be used as a prophylactic against return after all operations for the removal of deep malignant growths. Eighth: The area of exposure should be wide, and the intensity and quality of the rays should be adapted to each case.—*Med. Record.*

### Results With the Use of Radium.—Dr.

Robert Abbe, at the American Surgical Association at St. Louis, demonstrated a very powerful specimen of this element and presented a complete series of casts, photographs and radiograms which demonstrated the experiments he had been carrying on. He showed among other things the results of his experiments on the effect of exposure to radium rays plant life growth is markedly retarded. In like manner exposure to radium interferes with normal development of worms. Under the rays the worm lives, but remains a worm.

**Therapeutic Value.**—On small superficial epitheliomata the rays work well. They destroy, not as a cautery, but by some unknown subtle power. This power is a factor to be reckoned with, but as it is ten times more efficient than the Finsen light so is the x-ray tenfold the worth of the radium ray.

Dr. W. W. Keen, of Philadelphia, in discussing this paper said that he had employed radium in twenty-two cases, and that not in a single one was there any appreciable result save that the pain was stayed. He had temporarily relieved a case of tic douloureux. Possibly it was the type (German) of radium he used, but its strength had been reported to be 1,200,000.

Dr. Abbe, in closing, said that he never had intended to suggest the matching of radium against the x-ray. He reported what he did simply for scientific and pathological interest.



### Further Observations on the Therapeutic Value of Radium and Thorium.—J. M.

H. MacLeod concludes, in regard to the therapeutic value of radium bromide, that its chief utility is in the treatment of rodent ulcer, and in the case of small rodent ulcers it acts almost like a charm. In rodent ulcers of a diameter larger than a shilling, treatment by the x-rays is more practical, as the whole of the ulcer can be exposed at once. In some cases of rodent ulcer which have been subjected to a long series of exposure to the x-rays, these rays seem to lose their effect, and the healing process becomes stationary. Radium may then be used with advantage, and the healing again stimulated. The writer believes that radium is of little value in regard to epithelioma. In the case of cancer of the uterus, further experience is necessary before any definite statement can be made. In lupus vulgaris, radium causes the disappearance of the granuloma and a replacement of it by healthy scar tissue, but this treatment is practical only in very small lesions. It is a useful adjuvant to the Finsen light and x-rays, as it can be applied to positions which are difficult to get at. In lupus erythematosus its value seems to be negligible. The results of the use of thorium do not appear to be at all encouraging.—*Med. Record.*

#### Radium and the X-Ray.

The general discussion in the medical and lay press concerning the wonders of radium and the allied substances thorium and polonium, has aroused the public and the professional expectations to a pitch unwarranted by the results so far obtained.

As a matter of fact radium does not possess the power of penetration of the x-ray, which limits its field to the more superficial conditions. The blending of the three distinct radiations which characterize this remarkable substance may

adapt it to the successful treatment of certain conditions in which the x-ray does not succeed so well. On the other hand, it is probable that this very combination is certain to prove an objectionable feature.

As demonstrated the most penetrating of the radium rays, the  $\gamma$  (gamma) rays, are analogous to the x-rays, which explains the similarity of their action.

Observation to the present time has failed to demonstrate any striking advantage of radium. In a few instances its employment in association with the x-ray seems to have produced a better result than from the latter singly.

As to the probable therapeutic value of the internal administration of fluids rendered fluorescent by radium there is little to be expected, as solutions so affected lose that property when new chemical combinations are formed. At the present time those who have become familiar with the valuable therapeutic properties of the x-ray are not likely to set it aside for radium. In the superficial cases when the x-ray for reasons has failed, and in others, radium may assert superior effects and win a valued recognition. It deserves a thorough trial, but must be employed with great care and discrimination.—*Physical Therapeutics.*

**Failure of Electrocution.**—At the Ohio Penitentiary annex during the past week two miserable failures have occurred in electrocuting condemned men. Michael Shiller was given an initial shock of 1,750 volts, but revived; later he received 1,900 volts for eight seconds; this was run down gradually to 250 volts during fifty-three seconds, after three minutes he again revived and was again exposed to the current for two minutes. Moses Johnson, the second victim, requiring eighteen minutes of intermittent shocks before he was pronounced dead.—*Med. Record.*

**Radiotherapy in the Treatment of Tumors of the Stomach.**—Doumer and Lemoine have treated twenty gastric tumors by this method. Of these they believe that three cases were completely and finally cured. A fourth is on the way to recovery, while a fifth in whom the improvement was very rapid, and in whom the tumor completely disappeared, has had a relapse that does not yield to treatment. In the other cases the tumor has had a variable course according to the case. In all of the cases without exception this treatment has caused the disappearance of, or great diminution of, pain, and this from the first application. Vomiting has ceased or has greatly diminished, and feeding has thus become much easier. Without any doubt the general state has been greatly improved. Doumer and Lemoine conclude that there are certain forms of gastric tumors in which this treatment has worked a complete cure, lasting so far for a year and a half in several cases, and other forms in which the treatment has been incomplete in its effects, destroying the tumor in its original place, but not hindering its extension to neighboring parts and its metastases to distant parts.—*Le Bulletin Médical*, June 15, 1904.

#### Reaction After the Use of the X-Rays

—It is claimed by H. E. Schmidt (*Deutsche med. Woch.*, May 12, 1904) that there are premonitory signs which he terms "Frühreaktionen," which come on within a few hours after an effective application of the x-rays. These are not uncommon and are erythematous in character. They must be distinguished from the dermatitis usually associated with x-rays and which is not apparent until eight to fourteen days after their application. This erythema is independent of the age of the tubes and has only been observed in isolated cases, where a particular predis-

position seems to be present and where recurrence is almost invariable. The phenomenon apparently depends on some peculiar sensibility of the circulatory system to the rays, similar to that which has been demonstrated for other influences of a psychic, toxic or thermic nature.—*Medical News*.

#### Atmospheric Radioactivity.

Recent investigations have shown that radioactive gas may be obtained from water and from petroleum, this gas having the same properties as the emanation from radium. These facts suggested to Dr. H. A. Bumstead that some of this emanation must be present in the air above ground, and that the radioactive phenomena of the atmosphere might be due to its presence. An investigation has been carried out to determine whether such was the case. A long wire was stretched between two buildings and connected to the negative pole of a Wimshurst machine driven by a small motor. The other terminal of the machine was connected to the earth, and a parallel spark-gap kept the potential difference between the two constant. After allowing the wire to remain in this position for some time it was coiled up on a frame and placed within a cylindrical testing vessel, and the effect upon an electrometer noted. Curves were traced, showing the decay of the radioactive property of this wire, these curves showing a decided resemblance to radium emanation during the first two hours. When, however, the experiments were extended over a longer time, it was found that the rate of decay changed, becoming much slower than for radium. A possible explanation of this is that the radioactivity of the air is due to a combination of radium and thorium. The possibility of the presence of actinium was investigated and found to be improbable. The con-

clusion is reached that the radioactivity acquired by a negatively charged wire exposed to the open air is mainly, if not wholly, due to the excited activities of the radium and thorium. With a three-hour exposure three to five per cent of the total initial effect is due to the thorium activity. With a twelve hour exposure the thorium activity is sometimes fifteen per cent of the whole. There is some evidence that a small quantity of a more rapidly decaying activity is present in addition. It is thought that the radioactivity of rain and snow is due to radium-excited activity, the absence of the thorium effect being accounted for by the fact that the rapid decay of the thorium emanation prevents its reaching, in appreciable quantities, the height at which the rain drops are formed. —*Abstracted from the Am. Journal of Science, July, in El. Review.*

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**X-Ray of Cervical Rib.**—Dr. D. N. Eisendrath showed a skiagraph from a patient, fifty-six years of age, who consulted him on account of recurrent hemorrhages apparently from the lungs. The skiagraph showed beautifully the cervical rib. As regards the origin of this cervical rib, the only way one could understand them was to consider them as a reversion of type of the mammalia toward some of the elementary forms. This cervical rib existed in reptiles. It must be regarded as an abnormal development of the anterior nucleus of the transverse process of the seventh cervical vertebra.—*Med. News.*

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"I can't understand all this fuss about using electricity for executions," remarked Judge Lynch reflectively. "Out in our section we have used the telegraph poles for years."

### Roentgen Rays in the Dublin Law Courts.

The surgical possibilities and the legal liabilities of the use of the Roentgen rays were—for the first time within the British dominions—exhaustively investigated in the Dublin Law Courts last month. A lad, a resident of Galway, the seat of one of the "Queen's Colleges," was suspected of having needles lying within or near one of his knee joints. Professor Colohan (of Queen's College) sent him to the assistant in the physical laboratory, a man named Haire, to have the joint skiagraphed, in order to perfect the diagnosis. The result was not satisfactory, and after some repetition a Roentgen ray burn appears to have developed. Ultimately the boy was sent to Dublin for advice and treatment, and the comments there made on the origin of the cutaneous sore led to the legal proceedings. There were three actions brought by the guardians of the boy—one against Dr. Colohan, one against the laboratory assistant, Haire, and one against the college authorities.

The trial lasted seven days; twelve K. C.'s were retained thruout; the most noted experts were summoned from the other side of the Irish channel, and those of Dublin were necessarily pressed to the front. The evidence of Dr. W. S. Haughton, the premier Roentgen ray specialist of Dublin, was the conspicuous expert feature of the whole trial. Every possible aspect and every practical property of the Roentgen rays, in their relationships with human tissues, were thoroly thrashed out in open court, and the most up-to-date Roentgen ray machinery was made to display its modes of action to the jury. After the brilliant display of native science and native wit, nobody was surprised that the Roentgen ray specialists carried the opinions of the jury, and that a verdict was recorded in favor of the defendants. The



result must have taught something to the lawyers, as well as to the general medical and lay public for the trial was one of the most expensive that has taken place in Dublin for a long period, and the plaintiffs do not appear to be persons of any substance.

**THE VERDICT.**—Judge Gibson's charge to the jury occupied about three hours, and at the close he submitted the following series of questions for their consideration. Their perusal will well repay attention. We subjoin thereto the answers which were given by the unanimous decision of the jurors, after a conference of one hour:

1. Were the Queen's College, Galway, and Haire, or one, or which of them, employed for reward to photograph by Roentgen rays in December, 1902, and in April, 1903? Haire was so employed. College was not.

2. Was the sore caused by the rays? Yes.

3. Were the rays negligently applied as regards:

(a) Distance? No.

(b) Duration of such exposure? No.

(c) Consecutive multiplication of exposures? No.

(d) The type of machine? No.

4. Was the sore caused by the operation

(a) Of December 15? Can not say which.

(b) Of December 26 and 27? Can not say which.

(c) Aggravated by those in April? No.

5. (a) Did the operation of Dr. Colohan, for which Haire is not responsible, contribute to the sore? Yes.

(b) Did the operation of Haire, for which Dr. Colohan is not responsible, contribute to the sore? Yes.

6. (a) Was Haire negligent in applying the rays? No.

(b) Was Dr. Colohan negligent in applying or superintending? No.

7. Before the rays were applied in April was:

(a) Dr. Colohan negligent in not diagnosing the sore as caused by Roentgen rays? No.

(b) Was Haire so negligent? No.

8. (a) Was Dr. Colohan negligent in applying the rays in April after the sore appeared? No.

(b) Was Haire so negligent? No.

9. To what damage, if any, is the plaintiff entitled? None.

10. Is any, and what amount of such damages attributable to acts of Dr. Colohan only? Not answered.

(b) Is any, and what amount thereof attributable to acts of Haire only?

Not answered.—*American Medicine.*

**X-Rays in leukemia**—A dispatch from Turin dated July 11 states that Dr. Bozzoli, director of clinical medicine at the Turin University, has informed the Academy of Medicine that experiments he has made have shown that the x-rays have remarkable efficacy in some serious diseases of the blood. He says that he has cured by this means a supposedly incurable case of leukemia.—*Med. News.*

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I. N. DANFORTH.



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## The X-Ray in Renal Surgery.

BY I. N. DANFORTH, A. M., M. D., CHICAGO.

It is perhaps impossible to overestimate the value and importance of the x-ray in the diagnosis of the surgical diseases of the kidney, or, I should rather say, the differential diagnosis of these diseases, for the x-ray introduces a factor of certainty in place of uncertainty; a factor of exactness in place of inexactness; a factor of solidity and satisfaction in place of guess-work and doubt, and only those of us who practiced renal surgery before the x-ray was discovered can appreciate this. The younger surgeon can have no adequate conception of the darkness which surrounded the diagnosis of renal diseases requiring surgical interference before the advent of the Röntgen process. There is no superfluity of diagnostic illuminism yet; in fact, I have recently said in a paper published in another journal, that any operation on the kidney must be regarded as to a certain extent exploratory and diagnostic. Nevertheless, the Röntgen ray has the virtue of truthfully recording what it perceives, and then enables us to know what we are dealing with, or to know that we do *not* know, and that is infinitely better than stumbling along on conjecture merely. And this is particularly true in cases of suspected renal or ureteral calculus, which were formerly merely objects of lucky or unlucky guess-work, according to experience, skill or acumen of the guess-

er. Now, these elusive and sometimes provokingly self-contradictory bodies are forced to yield their secrets to the all-penetrating x-ray, and the surgeon can answer with a positive "yes" or "no," and feel that he is giving his patient an answer that he can rely upon. *Provided*, as the lawyers say in their ponderous documents, not written to be understood, *provided*, first, that the patient be properly prepared for examination, and especially that the gastro-intestinal tract be thoroly evacuated; and, *provided*, secondly, that the x-ray apparatus be handled by an expert and not by an amateur, and by an operator who does not jump at a conclusion from the indications of a single exposure only. The cause of skiagraphic diagnosis has suffered great injury at the hand of inexperienced and over-enthusiastic disciples whose zeal has outrun their judgment, and whose callow conclusions have often proved misleading and therefore exasperating. It does not contribute to a surgeon's growth in grace to be assured that a patient has a stone in his kidney, to have the x-ray proof triumphantly waved before his eyes, and then to operate with only negative results. But such results need not be if only proper care is taken and the results are verified by repeated exposures, until uniform findings ensue.

## Birthmarks.

BY H. PERKINS FITZPATRICK, M. D., CHICAGO.

The above caption is intended to cover all the congenital disfigurements of either vascular or pigmentary origin. The vascular nevi may be arterial and red in color, or venous and dark blue or purplish in color. The pigmentary nevi may be of so many different types, depending as it does upon the structural involvements, that it will be necessary to classify them. The most pronounced types are the nevi pigmentosus, the nevi pigmentosus piloris, and verrucosus.

Lately I have fortunately had one or more of these angiomas under treatment, directly or thru others, who have kept me posted as to results of their treatment by my method of electrolysis.

One recent case, a very unsightly nevus pigmentosus piloris on the chin and portions of under lip, very deeply pigmented and thickly covered with a very profuse growth of stiff wiry hairs, I completely removed in three separate treatments. I am convinced now that it could have been done in less time had I not been extra cautious from fear of scarring. The young lady, being the daughter of Mr. B., one of our best policemen, and she herself being quite comely. I took special pains to give the best cosmetic results, even if at the expenditure of more time than at first intended. This growth was elevated about one-eighth of an inch above the surrounding skin, was very compact and hard and deeply pigmented; in fact, almost black. It was circular, and while perhaps somewhat larger, presented about the size of an impression on the skin made by a silver dollar. There was in excess of 400 hairs, every follicle seemingly having developed. During the first treatment I removed the hairs by electro-

lysis, using the same method as noted in previous articles in this JOURNAL. The inflammation from the destruction of the hairs being considerable, I deferred the actual removal of the growth for a few days until the inflammation subsided. In removing the growth I made numerous insertions thru it, my intention being to reduce it to a level with surrounding skin. The procedure was the same as in removing moles and all elevated growths, as previously described in this JOURNAL.

The ensuing crust formation came off in about a week and I found upon examination that the nevus had been reduced to a level with the skin except in a few isolated spots. There were still a few hairs remaining, and I soon removed them and leveled off the few raised places—during this third and final treatment. Examination quite recently shows practically perfect results.

Dr. McGavran, of Kansas City, Mo., wrote me some time last July respecting the treatment by electrolysis of the little girl Edna D—, whose picture we show herewith:

A few days ago I received from Dr. McGarvan another photo, also shown in this article, which illustrates better than words what patience, persistence and proper electro-surgical application will do for these nevi.

This was a difficult case to treat owing to the youth (10 years) and consequent restlessness and impatience of the child. The nevi extended around the outer angle of and into the nostril, as is clearly shown in the first photo. It required great tact and much time to cover so sensitive an organ so completely, while the lines of demarkation are clearly outlined

showing extent of the growth, its location and involvements and its structural appearance can not be understood until described. The surface covered was about  $2 \times 2\frac{1}{2}$  inches. It was elevated, soft, fungus and warty. It was completely covered with large and fine hairs. The color was red and brown, and its appearance was decidedly repulsive.

angiomas require numerous and frequent treatments, and owing to the extent of the capillaries in these growths and the length of treatment to remove them, the skin will be somewhat whiter than normal, owing to the destruction of tissue and loss of natural pigmentation through the eradication of all dermal capillaries.

My method of treatment for these ab-



This growth was thoroly treated by electrolysis twice, and in and around the nostrils three times. The treatment was similar to that described in previous case and the results show for themselves.

Having treated nearly every type of angioma, I have no hesitancy in asserting that there is none but can be permanently removed by electrolysis. The pigmentary nevi can be quickly removed and with perfectly cosmetic results. The vascular

normal defects is always by electrolysis.

I find the negative pole best for needle attachments in cases of pigmentary nevi.

For vascular angiomas a mixed treatment, using, first, a positive current and then following up with negative current is the most rapid, but no more effectual than the negative current alone. However, the positive pole, owing to its more rapid decomposition of tissue, and therefore greater possibilities of permanently



scarring the patient, is used only in exceptional cases where we are obliged to sacrifice cosmetic after-effects for the sake of securing quick results. From a financial standpoint this treatment is not much of a success. Unfortunately, most of those coming for treatment are poor—too poor to remunerate the physician for his labor. But there is a great satisfaction to know you can do this work, and a greater satisfaction to actually do it.

No set rule can be given as to amount of electricity to use—ordinarily it is advisable to begin with the minimum

amount (say from 1 to 2 milliamperes) and gradually increase to point of tolerance. Best results in my cases have been met with by using from 3 to 5 milliamperes.

It is surprising how much more electricity one patient will endure than another. Therefore, owing to this idiosyncrasy of patients you will lose some of them before you can have an opportunity to demonstrate what your treatment will do unless you bear in mind that it is necessary to begin with a minimum current.

## Psycho-Therapy.

BY SHELDON LEAVITT, M. D.

### SUGGESTION CURES.

Outside the pages of a medical journal is seldom found so clear and concise a statement of a medical truth as that which follows:

That "all diseases are amenable to relief and cure" thru suggestion will be seriously questioned by nearly all. I take it that Dr. Corson intended to convey the idea that we can not set precise bounds to the curative action of suggestion in its various forms, without holding it to be an infallible cure. Quinine is a cure for intermittent fever, and is reckoned as a specific, and yet there are many cases of the disease which will not satisfactorily respond to it. Personally, I am not disposed to limit the curative action of suggestion to functional derangements of the organism, while, on the other hand, I do not contend that it will uniformly cure organic lesions. That it will sometimes do so I have demonstrated.

The philosophy of all cures wrought under the influence of Christian Science, Divine Science, Mental Science, and all the mind and faith cures, is absolutely ex-

plained. It has been found that these cures depend entirely upon suggestion. The explanation is simple and scientific. Any man or woman of ordinary intelligence and a common education can understand it. Not only so, but when properly understood and rightly applied in practice, by what we call Specific Suggestion, the management of all diseases heretofore treated by all mental or mind-cure methods is reduced to a positive science, and the results are marvelous. We assume that the law has been discovered by which the mind can be trained to control the bodily functions in health and disease, and that under this law, by suggestion, all diseases are amenable to relief and cure.

By suggestion in the treatment of disease we mean the presentation of thoughts to the mind of the patient in a manner and under conditions that will result in the functional and organic changes necessary to restore conditions of health.

That Christian Science, Divine Science, Mental Science, and other mental cure methods have relieved thousands of people nobody can deny. We should give them credit for all they have done, and for what they are still doing. But Specific Suggestion is always in advance of

all of these; it not only takes in all other methods of cure, but it simplifies them, and shows that they are all under the operation of one common, positive law, and that all people and all diseases can be reached and cured under this law, provided, however, that a cure be within the bounds of possibility.—*E. Hood Corson, D. S. T., M. E., in Our Home Rights.*

#### ANIMAL MAGNETISM THE CURATIVE PRINCIPLE IN HOMEOPATHIC POTENCIES.

Dr. Arthur Lutze, one of the foremost homeopaths of Germany in his day, gave explicit meaning to Hahnemann's term of "spiritual" as applied to the power resident in triturations and dilutions produced by one's own hands. Of course, homeopaths in general do not ascribe the effects of their remedies to something by them communicated. But any physician who cares to make a test will be convinced, if he proceed fairly with his experiments, that the "potencies" prepared by himself, or by the hand of one full of the homeopathic faith, will produce far better results than those made by artificial means.

I do not wholly agree with Dr. Lutze in ascribing results to "animal magnetism," but rather to a psychic force conveyed from the doctor to the patient thru the medium of the much-handled drug. To those who have no faith I recommend the experiment. There is much truth in the assumption.

Says Dr. Lutze:

"Some years ago I made the discovery, and have verified it by repeated observations, that animal magnetism is the vivifying, efficient power of our potencies. Every one who frequents my clinics has seen that the most violent pains often yield to a pass of my hand, to a breath, to a word. The zoëgmagnetic power may be transmitted to natural objects, pure water, pulverized sugar, wood, etc. I have the most striking proofs, showing that a powder of sugar upon which I

had breathed, or a glass of water which I had touched purposely, has produced the most marvellous effects. The thing happens in this wise: the noxious constituents of the drug are removed by attenuation; but the peculiar specific principle, which constitutes, so to say, the soul of the drug, remains, and is wonderfully excited during the shaking by the magnetic influence, and is rendered capable of curatively affecting the disordered nerves."—*Manual of Homeopathic Practice.*

#### MIND CURE FROM THE STANDPOINT OF THE MEDICAL PRACTITIONER.

That which follows, summarized from the *Boston Medical and Surgical Journal* of last month, is a straw showing which way the wind is blowing. Tho Dr. Edes' statements are rudimentary, and in some particulars misleading, they grant a portion of the truth for which in these pages we are contending. Old medicine is loth to admit that thot is a power capable of correcting pathological conditions already beyond the stage of functional disturbance, and accordingly seeks to limit and circumscribe its action. Yielding to the common prejudice, the Doctor clips the wings of truth when he declares that "over infections, degenerations, slow organic processes, such as control the duration of life, the general health and vigor of the constitution, psychic influence is practically nil." Experience in the psychic laboratories of life has taught us otherwise.

"Robert T. Edes considers it certain that there are many disease processes over which the mind can have no control. Such are pyrexia, anæmia, etc. Over many processes of nutrition, too, it can have little influence. Over infections, degenerations, slow organic processes, such as control the duration of life, the general health and vigor of the constitution, psychic influence is practically nil. Psychic influences comes in contact with organic processes only thru the nervous system, especially by vasomotor and secretory

nerves, and motor and sensory ones as well. The secretions of digestion are largely affected by the nerves; so are the functions of the bowels; hence, these are amenable to psychic influences. The functions of the kidneys and skin may, perhaps, be also so influenced. The intimate relations between the genital functions and mental and moral conditions are well known. So with the cardiac functions. In diseases that we call functional, the psychic influence has its greatest field. Still, in many forms of insanity, notably melancholia, it can not act. In cases in which symptoms counterfeit organic disorders, the mental healer finds his field. In neurasthenia, in which there is little real loss of nerve power, mental influences are of use; if there is real loss of nerve power this must be regenerated thru other means. Hysteria is the peculiar stamping ground of the mental healer. As to the methods of using mental healing, they are various. Suggestion may be made use of without hypnotism. The strenuous repetition of a positive assertion undoubtedly produces an effect. Many of the modern mechanical means of treatment do much of their work by mental effect, such as electricity, and various kinds of movements. As an adjuvant to the healing forces of nature and time, psychical influence will always be a precious resource to the physician."

A CONSIDERATION OF MENTAL THERAPEUTICS AS EMPLOYED BY SPECIAL STUDENTS OF THE SUBJECT.

What Dr. James J. Putnam says under this head in the JOURNAL last referred to is eminently sensible. I want to emphasize what he states to be "the problem" to be solved in the treatment of neurasthenics. Fear-thot in some form is at the bottom of all these cases. Cast it out, root and branch, from both the conscious and the unconscious thot, and health is restored: *provided, always*, that attention be given to environment and general sanitation.

"James J. Putnam tells us that some sort of specialized mental influence or education is often needed in cases of neurasthenia, aside from the improvement of nutrition. Another class of cases that may be benefited is that in which may be placed sufferers from morbid fears or occasional outbreaks of a hysterical nature. The problem is that of inducing in such patients the sentiments of courage, confidence, patience, and determination, and making them familiar with the dangers that are likely to threaten from without and within. In the class of diseases represented by morbid fears, fright psychoses, insistent ideas, and epileptiform or hysterical outbreaks, some of the best work has been done. A series of graduated efforts or one strong effort, in which the patient is supported by the physician, may overcome a morbid fear of long standing. Or such a fear may disappear before a determined attempt to go over and remember all the details of its first occurrence when it turns out to be not so dreadful after all. It has been found that painful experiences work mischief just because they are hidden from the patient's view. The hidden experience should be brot out into the clear light of consciousness. Hypnotism may be of great use here. It has been learned that it is erroneous to think that hypnotism tends to loss of independence and weakening of the will. In cases of traumatic hysteria we have examples of typically painful and insistent experiences occurring in persons not of hysterical temperament. They are peculiarly amenable to mental therapeutics. General and local treatment is also indicated along with the mental treatment. No attempt need be made to draw a sharp line between physical and mental therapeutics. A kinship exists between the influence that improves the nutrition of the brain by increasing the harmony and efficiency of its functions, and that which reaches the same end by improving the quality of its nutrient fluids, or the mode of their distribution."



## Mechanical Vibratory Stimulation.\*

BY GUY B. STEARNS, M. D., NEW YORK CITY.

The most recent application of vibratory stimulation in the treatment of diseased conditions depends on the presence, in the spinal cord and adjacent parts, of centers having reflex and automatic control of the different functions of the body.

A knowledge of the position of these centers and of their several functions is necessary for the correct application of this treatment. In fact, no branch of medicine calls for a more exact knowledge of the physiology and anatomy of the nervous system than does the one which is the subject of this paper.

Because of this fact I must crave indulgence if in the description of the underlying principles of the treatment I repeat much which is a part of your everyday knowledge.

The most important function of the spinal cord which relates to this subject is its power to receive impulses thru the afferent nerves and to distribute them to nerve centers, where they originate new impulses which pass out from the cord along efferent nerves to muscles, organs and other tissues, producing activities in them. This is known as reflex action. It is not simply an occasional function called into use to meet unusual conditions, but one which is continuous whether we be awake or asleep. It is the means by which the body adjusts itself to its constantly changing surroundings; to the varying degrees of atmospheric temperature. On it the organism depends for the regulation of assimilation; the carrying of nutritive material to worn-out parts, and the excretion of waste. No function of the body

escapes its control, and the lines of communication between the different working parts are always busy.

In the spinal cord are the centers which control directly or through the sympathetic nerves every function having to do with the health of the body.

In order to appreciate the method by which afferent impulses are sent to these different centers, an understanding of the mechanism and distribution of the posterior nerve root terminals is essential.

Every nerve fiber as it enters the cord through the posterior root divides into two branches. One of these passes upward and the other one downward. The lower root is usually short, but the upper one is much longer, in some cases extending nearly the whole length of the cord. At intervals these two branches give off secondary branches called collaterals, which pass forward, breaking up into a terminal branch of filaments like the root of a plant, which meet and mingle with similar sets of branching fibrils connected with the motor nerve cells. Passing off from these cells into the anterior roots are their axis cylinder processes, which emerge from the cord in bundles, making up the anterior nerve roots. Before entering the intervertebral foramina, the anterior root joins the posterior, and they emerge from the spinal canal as one nerve trunk containing mixed fibers. The axis cylinder processes from the motor cells continue as individual fibers until they are distributed to the different structures whose functions they are to influence. Some pass to voluntary muscle fibers ending in a muscle nucleus or end plate, while others enter the lateral

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\*Read before the Massachusetts Homeopathic Medical Society.

chain of sympathetic ganglia and pass from thence to collateral ganglia, being finally distributed to the viscera.

Going back once more to the posterior nerve root we find the following distribution of its fibers. It first divides into two sets, a lateral and a central set; the lateral does not enter the gray matter of the cord at all but passes directly into one of the marginal columns, where its fibers divide and the branches pass up and down as already described. The central set passes into the post horn of the gray commissure opposite its tip, coming into contact with its cells. A portion of them go to a group of cells near the posterior commissure, sending a few thru the commissure to corresponding cells on the other side. The remainder pass forward thru the median gray to cells in the anterior horn.

Bearing in mind this wide distribution of the fibers making up the posterior root, and the fact that each fiber gives off collaterals, bringing them into relation with the intrinsic cells of the gray matter at the different levels of the cord, it is not difficult to understand how an impulse can pass up thru any centripetal nerve and set up a reflex action in any part of the body, involving either a single organ or muscle or any number of structures.

So long as conditions are normal these reflex actions have a distinct purpose for the automatic control of the various functions of the body both in the intensity of their action and in their relation to each other. In disease, however, they may become very erratic, setting up abnormal activities in distant parts which in turn react and send back impulses to the cord that are reflected to the original point of irritation. These may act and react on each other indefinitely until the abnormal circle of activity is broken by some outside influence.

The spinal nerves, as we have seen, contain both afferent and efferent fibers. After leaving the intervertebral foramina, each divides into three branches. One of these, the dorsal, supplies the muscles, skin and other tissues of the back; the second or ventral in a similar manner supplies the tissues of the anterior part of the body and the extremities; the third, which most concerns us, is known as the visceral branch or *ramus communicans*. In this the fibers are destined to make up that portion of the nervous system known as the sympathetic.

The fibers composing the sympathetic nervous system are of two kinds, gray and white, of which the white originate in cells within the cord and carry efferent impulses; while the gray transmit impulses to the cord from the organs and tissues which they supply. Part of the fibers making up the *ramus communicans* go directly to the lateral ganglia from which branches are passed along to the collateral ganglia that in turn send them into the organs, where they terminate either in distributing fibers or in terminal ganglia. The remaining filaments go to make up the splanchnics without entering the lateral chain at all and terminate in the collateral ganglia.

*It will thus be seen that the sympathetic system originates in the central nervous system and is an integral part of it, and its fibers transmit impulses both to and from the cord exactly as do the spinal nerves.*

All nerves, whether cerebro-spinal or sympathetic, carry impulses in both directions, and the resulting action depends not on the nerve but on the end organ; if it ends in a muscle, contraction occurs; if in a secreting cell of a gland, secretion results; if in the aborescent terminals adjacent to a motor cell, reflex activity of some sort.

Reviewing the different parts of the sympathetic system, it admits of the following classification: from the cranium there extends to the pelvis a double chain of ganglia located on each side of and in front of the vertebra: these are known as the vertebral or lateral ganglia. They are connected with each other by communicating fibers called the internodal branch, and with the cord by that division of the spinal nerve described as the visceral branch. They correspond very nearly in number to the vertebra, except in the cervical region, where there are but three; the superior, the middle and the inferior. In the thoracic region there are usually twelve, in the lumbar region four, and in the sacral region four or five; the two chains finally uniting in a single bundle of fibers in front of the coccyx, known as the ganglion impar.

In front of the vertebral column is another more or less complete chain, known as the prevertebral ganglia, made up of the cardiac, the solar, and the hypogastric plexuses: situated respectively in the thorax, the abdomen, and the pelvis, and composed of fibers given off from the lateral ganglia and from the visceral branch of the spinal nerves.

A third set of ganglia, consisting of minute ganglionic structures, is scattered thruout the different organs and tissues, and is known as the terminal ganglia. These ganglia receive fibers from the great plexuses, from the lateral ganglia, and from the central nervous system.

The ultimate branches of distribution derived from the lateral ganglia, the prevertebral plexuses, and the terminal ganglia supply the muscles of the vascular system, the muscles of the viscera, and the secreting glands of the different organs. Their distribution indicates their

function, for they have absolute automatic control over the structures in which they terminate, and their action is either stimulative or inhibitory. Thus to the heart pass fibers known as cardio accelerators and others known as cardio inhibitors; to the blood vessels pass fibers which produce contraction of their muscular walls, known as the vasomotor nerves, and others which cause the vessels to dilate, known as vasodilators; to the involuntary muscles of the hollow viscera, as the intestines, the uterus, bladder, and so forth, pass fibers which carry impulses causing them to contract and others which cause them to relax. On these two sets of fibers depends the peristaltic movements of the intestines, stomach, and esophagus.

There appears likewise to be a double nerve supply to the glandular system, having to do with the increase and decrease of secretion.

In addition to the vasomotor, visceromotor, and secretory functions, the sympathetic system appears to have control over nutrition, certain fibers seeming to cause increased metabolism and breaking down of tissue, followed by exhaustion; while others conserve tissue destruction and increase the growth of the cells.

Glancing in retrospect over this general description of the nervous system, we find direct communication between the sympathetic ganglia and central nervous system by means of the rami communicantes; we find an intimate relation between the different ganglia thru their connecting fibers; we find in the cord an elaborate arrangement whereby thru collaterals, impulses can be distributed to different centers in the cord, and from thence reflected to different parts of the body, thus bringing into close relation every structure and every tissue. From these facts we may deduct the following



postulates and experience has proven them to be facts: first, an irritant in any organ or tissue may affect reflexly any or all parts of the body: secondly, that such irritation may travel in either direction and may originate either in the sympathetic or in the central nervous system and be reflected into the other system. A familiar example of reflected irritation is the many nervous symptoms, headache, and so forth, resulting from displacements of the uterus, morbid impulses radiating through the whole chain of sympathetic ganglia, finally manifesting themselves in these distressing symptoms, while the person suffering may not suspect the source of the trouble.

Since the primary cause may be far removed from the point where the distressing symptoms occur, we can not be too searching in our examination and inquiries if we wish to treat directly and successfully.

An irritation to any of the viscera whether due to mechanical causes, bacterial invasion, or chemical agents at once starts impulses along the sympathetic nerves and these are reflected to the proper centers for sending more blood to the irritated part. Inflammation is the result and a battle royal takes place between the leucocytes and the invading substance; ending, if the vital resistance of the body be strong enough, in a victory for the defenders, but at the cost of many soldiers and much material of war.

The excretory organs, receiving messages from the field of battle in the same manner, respond with greater activity and soon clear away the debris. Nature is proverbially lavish in responding to calls of any kind, and when replying to the calls of a diseased organ there is almost always an overflow of activity; this manifests itself usually in structures supplied

by nerves originating near the point of reception of the morbid impulse.

If disease affects the viscera, the overflow of activity or impulse passes to the nearest center in the spine, is reflected to motor cells in the anterior horn, from thence thru the nearest posterior division of the spinal nerve to the contiguous muscles of the spine controlled by these nerves and produces in them contraction and congestion.

It is one of the laws of physiology that the contraction of a voluntary muscle induced by reflex irritability is maintained for some time, even after the irritation has been removed. This abnormal contraction produces pressure on the nerve filaments terminating in the muscles, acting as an irritant to them. They respond in the only way possible and send back an impulse to their centers which is reflected to the organ originally affected.

An activity having once occurred, its repetition becomes easy, the tendency being always toward its automatic continuance. If we may use the comparison, a groove has been worn in a certain portion of the nervous mechanism leading from an organ to a center, thence to another structure, back thru another center to the first tissue affected; and over this pathway is constantly flowing a stream of nervous energy that continually acts and reacts upon the structure which it influences, a constant round of nerve activity that has been aptly termed a vicious circle.

Abundant experience has proven that if sufficient pressure be applied over the contracted muscles to cause them to relax, the abnormal impulses will be inhibited, and all the involved tissues will resume their normal functions. In fact, certain phenomena relating to this phase of the nervous system have led me to believe that in many cases of reflex nerve irritability,

where a vicious circle has been established, pressure anywhere in the circle sufficient to inhibit for a time the continuance of the nerve vibrations will bring about permanent curative results. But since the spinal muscles are so easily accessible, they offer the most convenient point at which inhibitory pressure can be applied.

As an irritation from a diseased organ is usually reflected to the spinal muscles having the nearest adjacent centers in the cord, it would follow that disease of any organ would produce contraction in definite areas; and, conversely, if the muscles of any region be contracted they would indicate pretty accurately the internal organ affected. A study of the vasomotor distribution to the different organs and structures will give the necessary data for determining the regions of the spine corresponding to the various internal organs.

The spinal vasomotor nerve cells are scattered thru the anterior horns, mostly between the second dorsal and second lumbar vertebra. The upper extremities, the lungs, the bronchi and the head are supplied by that portion of the cord above the sixth dorsal vertebra. The abdominal organs derive their vasomotor supply from between the fourth and twelfth dorsal, those fibers going to the right side innervating the liver and a portion of the digestive organs, while from the left are supplied the stomach, spleen and remainder of the digestive organs.

The blood supply to the kidneys is controlled by cells in the region of the tenth, eleventh and twelfth dorsal segments. The pelvic organs have their spinal vasomotor control thruout the lumbar region, a point of especial importance being at the junction of the fifth lumbar vertebra with the sacrum.

Besides these, there are several special centers of control.

Notably: Between the eighth and ninth dorsal vertebra is a center influencing the cervix uteri. The pylorus has its center between the fourth and fifth. At the sixth is a center for the kidneys. Between the first and second lumbar vertebra is a center for the body of the uterus.

Although an irritation to an organ is usually reflected over the shortest route, and causes contraction of the nearest related spinal muscles, it does not invariably follow, for the irritation may be reflected anywhere. Where a disease has lasted a long time the continued contraction results in exhaustion and finally in atrophy. The posterior spinal processes in such a case appear very prominent, the muscles having shrunk away from them. This usually corresponds to a sclerosed or atonic condition of some of the internal organs or a general lack of systemic tone with anemia.

An irritation does not necessarily originate in a visceral organ, but may come from the spinal region and be reflected to the internal organs. The spinal muscles are not only especially susceptible to reflex irritation, but to direct stimulation as well, contractions occurring as a result of drafts, blows, etc. The reason for this is because of their peculiar duties. Every voluntary muscle is constantly on the alert to maintain equilibrium whenever an individual assumes the upright position. This is one of the automatic reflex functions of the whole voluntary motor system. The muscles of the extremities, however, are much more constantly obeying the will in making specific and definite efforts than are the spinal muscles, while the latter have fully as much as the automatic work to perform. By an effort of the will, reflex action occurring in the voluntary muscles can be repressed and in many cases abolished.

As an example of this is the patella reflex, which can not be obtained if the patient strongly opposes it. Permanent contractions of the muscles of the extremities do not occur as a result either of reflex or direct stimulation, because they are constantly responding to a higher force, the will. The spinal muscles, however, since they are called on for very little voluntary effort, but are constantly thrown under the influence of the automatic sphere, respond readily to any outside or reflex stimulation.

The muscles are not the only structures which are affected reflexly, and are factors in producing or perpetuating morbid conditions. The intervetebral ligaments may become contracted thru irritation and impinge on the nerves emerging from between their corresponding vertebra. Or, what is oftener the case, the ligaments may become relaxed, allowing the vertebra to become separated, setting up an irritation in the nerve roots emerging at that point.

Such points of separation are oftenest found at the second dorsal interspace, between the last dorsal and first lumbar vertebra, and between the last lumbar vertebra and the sacrum. Whenever such a condition is present, pressure on either side of the spine at that point will cause pain. So commonly are they present at the points mentioned, the osteopaths have designated them as weak points of the spine. The space between the sacrum and last lumbar segment is very important in relation to diseases affecting the bladder, the prostate or any part of the generative organs. The articulation is such that any deviation from the normal relation of these bones will almost invariably produce enough tension on the bundle of nerve fibers passing thru the spinal canal at this point to start abnormal impulses thru them. A very common result

of such an irritation is the inability to retain the urine long at a time, and inhibitory pressure at the sides of the gap will usually entirely relieve the condition after a very few applications. The results are very gratifying to those who are obliged to relieve their bladder several times at night.

Separation below the twelfth dorsal is apt to be associated with irritation of the kidneys, as well as of the structures in the lower abdomen and pelvis. Numbness of the hands occurs with separation at the second dorsal interspace. When the condition is found at other points, vasomotor and functional disturbances will occur in the organs and tissues having spinal centers in contiguous regions of the cord.

Very often, in disease of the pelvic organs, the line of junction between the sacrum and the innominate bones will be found very tender. When such is the case a careful examination of the hip bones and a comparison of their relations to each other and to the sacrum will often show one to be slipped slightly out of place, usually up, causing a tension on the sacroiliac-ligaments.

By first applying vibration with enough pressure to thoroly relax the ligaments and muscles, and then manipulating the bones back into position, the whole line of reflex symptoms disappear.

I must give the osteopaths credit for this point, for when I was first told that one of the pelvic bones could slip on the sacrum I was decidedly skeptical. But when I studied the articulated skeleton I was obliged to admit, not only the possibility, but the great likelihood of such an accident occurring in those of relaxed fiber, from any unusual jolting or even from being on the feet a great deal. The use of the vibrator first has a great advantage over simple manual replacement,



for by first relaxing all the ligaments reduction is more easily accomplished.

In the ribs we occasionally have another source of irritation.

During violent respiratory efforts, as in sneezing or coughing, or from sudden twists or movements of the body, there may result a slight displacement of one of the ribs. This can be detected by sliding the examining hand down the back, over the angles of the ribs, and the one affected will be found more prominent than the others. If this occurs at the fourth ribs, nutritional changes take place in the muscles of the upper extremities, notably the deltoid, causing pain or even inflammation. Conversely, whenever inflammation occurs in the shoulder muscles a sensitive spot will be found at the angle of the fourth rib, just beneath the edge of the scapula. And in the majority of cases vibration applied at this point will relieve it, whether it be the result of a displaced rib or not. This point and the vasomotor area for the upper extremities are important ones in connection with professional neuroses.

Norstrom has called attention to the fact that myositic deposits occur in the muscles of the forearm in this disease, and that often by massaging them away the condition is cured. I have observed these deposits, not only in the muscles of the forearm, but even more characteristically in the *infra spinatus* and the *latissimus dorsi*, near their insertion into the humerus.

Treatment over the vasomotor area of the affected arm will give much relief, but it is also essential that the absorption of these deposits be hastened. This can be accomplished by means of massage, but the process is tedious and laborious.

It is much more quickly accomplished by means of vibration applied directly to the infiltrated areas. Each area of infil-

tration should be carefully sought out and thoroly softened.

A displacement of the sixth or seventh ribs on the left side is always accompanied by some disturbance in the stomach, manifesting itself by acidity and flatulence. Indigestion originating in the stomach sends a reflex irritation to the back, which is felt at the angles of the ribs between the third and the seventh, on the left side. If a rib be displaced the quickest and easiest way to correct it is to place the patient face down on a table and elevate the arm of the affected side very strongly, so as to put the pectoral muscles on the stretch. At the same time place the vibrator on the angle of the offending rib, giving hard pressure, and the bone will be jarred into place. The same treatment is valuable in indigestion without any displacement of the ribs, applying the pressure successively at the angles of all the ribs in this region.

By directing the patient to drink a quantity of warm water and then inhibiting the center controlling the pylorus that structure will relax and allow the contents of the stomach to pass thru into the small intestines. Such a procedure is just as effective in the treatment of gastric catarrh as the ordinary method of lavage, and decidedly less disagreeable to the patient. Since water is so rapidly absorbed from the intestines, the volume of the blood can very quickly be increased, making this a valuable adjuvant in renal insufficiency.

The technic is simple, the patient lying on the right side with the feet drawn up, while hard pressure is applied with the vibrator at the left of the spine, between the fourth and fifth dorsal vertebra, the operator pressing firmly with his hand over the epigastrium.

In official work vibration accomplishes much, for by means of it the sphincter

ani can be painlessly and quickly relaxed, with none of the dangers or bad after-effects following rapid divulsion under ether. For this purpose a round rubber terminal, about four inches long and a half-inch in diameter is attached to the vibrator arm, and after being well lubricated is introduced through the sphincter while the machine is running. This treatment is one of the most gratifying in hemorrhoids, the pain ceasing immediately, while the swollen vessels seem to fairly melt away under its action.

Through the anus, also, the prostate gland can be reached, and it has proven useful in the treatment of enlargement of that structure.

The foregoing covers the rudimentary framework on which is built the theory of vibratory treatment. The finding of contracted muscles, of variations from the normal tone in other tissues and of deviations in the bony framework is not difficult. The attainment of skill in this direction only requires practice, and when once attained is as definite and exact as any method of physical examination and diagnosis at our command.

The reason why vibration is the most efficient method of mechanical treatment is because of its peculiar effect on living matter. It approaches more nearly the natural bioplasmic movements of the tissues than any other form of stimulation.

When applied moderately and for a short time it stimulates the cells, increasing growth and activity. If prolonged it causes depression and exhaustion of the cells, and finally if continued long enough disintegration and death. If given with hard pressure it inhibits activity in the tissues submitted to it. Therefore the method of application depends on the result desired.

Where there is lack of tone or deficiency of activity in any organ, gentle vibration for a short time, applied either directly to that organ or anywhere along the nervous mechanism controlling it, will stimulate it to greater activity. When the opposite condition is present, and there is abnormal activity, it can be inhibited by longer application, combined with hard pressure.

So far as I have been able to observe, the rapidity of the vibrations is of less importance than the amplitude of the stroke and the degree of pressure. It should be rapid enough so the patient can not distinguish the individual strokes, but not so rapid as to cause friction on the tissues.

Before commencing the treatment of any case, the condition of the excretory functions should be inquired into, and often the first treatment should be directed entirely to the liver and kidneys.

This can be made a general rule in conditions at all acute, for in those cases the blood is already overcharged with the products of retrograde tissue changes, and if any more be set free before the liver and kidneys are able to take care of them more harm than good will result. It is very important to bear this in mind in treating cases recovering from acute inflammatory rheumatism. Myositic deposits are found scattered thruout the whole muscular system, as well as contraction of the spinal muscles, and if these deposits be treated and broken down at once, needless suffering will result and possibly a relapse.

In diseases associated with glandular engorgement the proximal nodes should be treated in order that they may free themselves and assist in bringing about resolution in the diseased tissues.

This applies particularly to catarrhal conditions of the nose, throat and ears, and to infections of the urethra. In the former cases the glands in the neck should be stimulated, and in the last those situated in the groins.

One caution should be observed in using vibratory treatment, and that is not to treat too long, as there is danger of over-stimulation. A careful diagnosis should first be made of the condition present, and the treatment directed as specifically as possible.

All stimulation to the parts not requiring it draws just so much from the parts where the effects are desired. Ten to fifteen seconds are sufficient at any point for stimulation, and one to three minutes for inhibition. Longer is harmful or inefficient.

While patients are being treated they should be placed in a position admitting of absolute muscular relaxation. Otherwise the effects of the treatment can not be properly isolated. The prone position best admits of this, the patient lying on the treatment table flat on the abdomen, with the hands hanging loosely over the sides. The table should be long enough so the feet do not project beyond the end, otherwise the lumbar muscles will be put on the stretch, thus obscuring conditions in that region, or misleading the operator as to their true condition. The head should be supported by a small pillow, and turned so as to rest on one or the other cheek, instead of on the forehead, this position allowing of the most complete relaxation of the muscles of the dorsal and cervical region.

This same position is the best for making examinations for determining the tone and condition of the tissues, for finding sensitive spots, and for discovering deviations of the bones.

In making a survey of the body for the purpose of determining if there are any deviations from the normal curves of the spine, and for examining the contour and development of the thorax, and for observing other general points, the patient first having removed the clothing to the waist, should be seated on the table, with the feet hanging unsupported over the side and the hands hanging loosely in front.

This position brings out, better than any other, general abnormalities of the spine and thorax.

There are certain essential points in a machine for giving vibration. It should have flexibility of the moving parts, so it can be readily brought to any part of the patient's body, with rigidity enough so the vibrations are not transmitted into the hands of the operator. The part giving the vibration should have a lateral movement rather than a rotary or up and down. I have found the most efficient one to be one with the vibrator attached directly to the motor which runs it, the whole thing swinging on a many jointed arm. The flexible shafts are prone to break at critical moments and the handle of the vibrator receives too much of the movement. The stroke is apt to be uneven, thus breaking up the continuity of the impulse.

The cases I report are taken from the records of the department of physical therapeutics at Flower Hospital.

Case I—German, sixty-five years of age, Came to the clinic January 19, 1904. About six weeks before, during a very cold night, slept with his head near an open window. Next morning suffered excruciating pain over left side of head and face. This ceased after a day or two, but from that time until coming to the clinic could not open the left eye. Examination showed the following condi-



tion: The lids of the left eye were swollen and he could not open them without the aid of his fingers. On opening the lids the parts beneath were swollen and injected, the blood vessels standing out very prominently.

The cornea was very hazy. The pupil was dilated and did not respond to light. There was complete paralysis of the muscles supplied by the third nerve, the external rectus alone acting, rolling the eyeball out in extreme abduction.

Vibration was applied at the second dorsal interspace, on the left side, and over the cervical sympathetics of the same side.

Very gentle vibration was applied over the eye.

Improvement commenced with the first treatment, there being a marked decrease in the swelling and injection. After twelve treatments he was entirely cured and said he could see better than for two or three years. The improvement in the paralysis commenced at about the third treatment. As the haziness of the cornea cleared up I discovered he had a commencing cataract.

Case II—Young man aged twenty-two. Has had catarrh for many years.

During last four years has been very deaf, so much so can hear only when shouted to. Has constant noises in the ears. Constant post-nasal dropping. During last four years has treated at the different ear clinics, but has constantly grown worse. Very despondent on account of his deficiency, and often talks of suicide.

There was marked retraction of the drums and he could hear the watch at a distance of four inches for the right ear and five for the left.

Treatment was given at the seventh cervical vertebra, both sides, and over the upper and middle cervical ganglia. The

glands and deep structures of the neck were also stimulated.

He has been under treatment six weeks and reports as follows:

Almost entire cessation of the subjective sounds in the ears; entire relief from the post-nasal dropping, and great improvement in hearing. By the watch test he can hear nearly double the distance he could before commencing the treatments.

I have just commenced treating two other cases for the same condition; one a young lad about six years old, who is even now showing improvement, after only three treatments; and the other a man over forty, who has been deaf for twenty years.

This is not the first time vibration has been applied to the sympathetics in eye and ear conditions, for a few years ago an English physician reported some cases treated in this way.

The object of the treatment in both the cases I have mentioned was to increase the blood supply to the parts affected, and what was fully as important, facilitate drainage by improving the condition of the proximal glands.

Case III—Carpenter, aged sixty-five. Diagnosis, multiple neuritis of rheumatic origin. Duration of disease, nine months. Cause, exposure.

Left arm helpless, right one practically so, there being only slight use of the shoulder and upper-arm muscles of that side. Had been treated by means of electricity for several months, with very little improvement. On examining the back I found a drooping of all the ribs, with marked inelasticity of the thorax, and a slight backward displacement of the fifth rib on the left side. There was marked tenderness at the angles of the ribs on both sides, from the third to the seventh.

Treatment has been applied almost entirely at the angles of the ribs in the region mentioned, working the displaced one back into position, and elevating all the others. There has been a steady though slow improvement from the start, the shoulder muscles being the first to respond. Has been given thirty treatments to date.

Case IV—This case is one of progressive muscular atrophy. The patient, a man of about forty, was for many years a motorman on the street cars. About six years ago was severely chilled, being nearly frozen. Since then there has been a gradual wasting of the muscles of the upper extremities, first appearing in the abductors of the thumbs. Now has no use of the arms or shoulders, the arms hanging as though they were useless appendages, attached by wires. The hands were swollen and blue.

Examination showed, in addition to the wasting of all of the muscles of the arms and shoulders, a marked separation between the fifth and sixth cervical vertebra. The knee jerks could not be obtained, tests with the galvanic current showed degeneration in the gray nucleus of the cord. His face was dull, and countenance heavy and apathetic. He complained of fullness and noises in the head.

Gentle stimulation was applied from the second to the tenth dorsal vertebra, close to the spine, so as to affect the vasomotor supply to the extremities, thus increasing the nutrition to the wasted muscles and to the cord. Special light stimu-

lation was applied to the point between the fifth and sixth cervical vertebra, where the separation occurred, together with stretching and manipulation of the relaxed ligaments. The treatment to the neck relieved at once the fullness of the head and the subjective noises, and changed his whole expression to one of hopefulness. He is steadily gaining control of his muscles, those about the shoulder having increased appreciably in size. Previous to coming under this treatment he had been treated with electricity, but had steadily failed.

I have treated three cases of paralysis agitans by this method, with some improvement in each case. In all cases of this disease that I have examined, there has been extensive contraction of the spinal muscles, including the quadratus lumborum and the latissimus dorsi, and the improvement seemed to be in exact proportion to the relaxation I could produce in these muscles.

I have also used this treatment very successfully in breaking up adhesions in stiffened and ankylosed joints. The adhesions should be stretched while the vibrator is applied, as by this method they yield more readily.

Cases and specific suggestions could be multiplied indefinitely, but enough have been presented to illustrate the underlying principles, and those having been grasped, their application becomes a process of reasoning for each individual case. —*The New England Medical Gazette.*



# Electro Therapy.

A Course of Twenty-four Lessons under the auspices of the Chicago College of X-Ray and Electro-Therapeutics.

## LESSON 14—X-RAYS. By T. PROCTOR HALL, Ph.D.

Twenty-five years ago Sir William Crookes was experimenting with the newly-discovered radiant condition of matter. Up to that time three forms of matter were known, namely: Solids, in which the particles retain their relative position; liquids, in which the particles move easily among themselves, but retain distinct cohesive properties; and gases, in which the increased rapidity of motion of the particles has exchanged the cohesion for repulsion, so that the particles of the gas always fill a confined space, no matter how large it may be. Crookes discovered that when a vacuum had reached a certain point the character of the inclosed gas was distinctly altered, the particles present being so few in number that when one was electrically repelled from the kathode it passed clear across the vacuum without striking any other particles on the way, and landed upon the opposite wall of the tube. The particles shooting across in this way form the kathode stream. A tube whose vacuum is such that a kathode stream is possible in it is called a Crookes tubes. Up to the present a Crookes tube forms the only available source of x-rays.

A great deal of experimental work was done upon kathode rays by Crookes, Lenard, Roentgen and others. It was found that kathode rays travel in straight lines, that parallel streams repel each other like electrically-charged particles, that the steam is capable of doing work, such as turning a mill, that the side of the tube the rays strike against becomes hot, and when the rays are brot to a focus upon one point the glass may be melted and driven outward against the pressure of the air by the impact of the

kathode particles. The stream flies from the kathode at right angles to its surface. When the kathode is dished the stream comes to a focus at a little distance from the kathode. When the kathode is convex the stream is scattered. Most x-ray tubes have the kathode dished to such an extent as to bring the stream to a focus as it strikes a platinum disc in the center of the bulb. From this platinum disc the stream is reflected almost evenly in all directions, and the reflected and scattered stream strikes the wall of the tube, causing fluorescence over that half of the bulb.

Wherever the kathode stream strikes against the wall of the tube with sufficient force, x-rays are produced. X-rays are probably produced when any solid body is struck by the kathode stream. In the ordinary tube it is still uncertain whether the majority of x-rays have origin from the platinum disc in the center of the tube or whether they are produced at the surface of the tube, where the reflected stream strikes the glass. The rays behave, so far as direction is concerned, as if they came from the center of the tube, and for radiographic purposes it is most convenient to consider the center as the point of origin, bearing in mind at the same time that irregular small kathode streams cause some x-rays to start from different points at the surface of the tube.

X-rays radiate from the tube in straight lines. They are invisible; they do not cause fluorescence in ordinary glass; they can not be deflected from their course by a magnet (differing in this respect from kathode rays), nor, indeed,



by anything, but they are irregularly reflected or dispersed by all bodies.

X-rays differ from each other in their capacity to penetrate dense bodies. This property of penetration is of the greatest importance. The rays from a tube whose vacuum is low have very little penetration; those from a tube of high vacuum have a high degree of penetration. Some x-rays are scarcely able to penetrate the skin, others pass thru the human body with ease.

The penetration of a ray may be measured by a comparison of the relative thickness of two metals of different density, which are required to give equal illumination. Roentgen employed for this purpose a platinum plate pierced with holes containing aluminum plates. The author has recently completed a penetrometer, whose essential feature is two movable metallic plates, increasing in thickness from end to end, which, upon being adjusted to give equal illumination over a small opening, gives upon a scale a number representing the penetration of the rays. The working scale runs from one to ten. Zero of the scale would indicate rays whose penetration is alike for all metals (a kind of rays which has not been found). Number ten on the scale indicates a ray which passes thru metallic tin ten times as easily as thru lead.

Nearly all of the penetrometers upon the market measure not the penetration, but a mixture of the penetration and the intensity of the ray, and are consequently worthless. It is possible, in most cases, to estimate the penetration of the rays by viewing the bones of the hand or arm. If these are dark, with clear-cut outlines, and the soft parts moderately light, the penetration is moderately low. If the bones are light, or if they are dim with indefinite outlines, the penetration is

higher. But the most experienced observers are not infrequently mistaken in their estimate of the penetration of rays when they depend upon this method.

Penetration of the rays is increased by any method which increases the impulsiveness of the electrical discharge thru the tube. A moderately high electromotive force and a series of small spark gaps in the electric circuit is, therefore, advisable; but it is quite unnecessary for ordinary purposes to use an electromotive force more than sufficient to give an 8- or 10-inch spark thru air. A tube whose vacuum is so high that a current can not be produced in it by an 8-inch coil is too high for any practical use. The older Ruhmkorff coils were made to give an exceedingly small secondary current, and it was necessary to use a large coil with high electromotive force in order to secure a current heavy enough for x-ray work. Coils are now built to deliver any required quantity of current and a high electromotive force is unnecessary. The intensity of the x-rays depends upon a number of factors, some of which are imperfectly understood. Of these the quantity or intensity of the current is most important, and is almost the only one which is under the control of the operator.

The rays from a focus tube scatter as they go and follow the law of all radiating forces, namely, that their intensity decreases in proportion to the square of the distance from the center of the tube. In viewing the rays with a fluoroscope the diminution in the intensity of the rays seems to be porportionate to the distance, because our perception of illumination is proportional to the square root to the intensity; but for radiographic work it is important to bear in mind the law of the inverse square.

## Pathological Changes in Tissue Under the Influence of the X-Ray.\*

BY WILLIAM S. NEWCOMET, M.D., PHILADELPHIA.

The subject of the pathological change in tissue under the influence of the x-ray is one of considerable latitude, and in this article it will be covered only in a general way, as detail must be avoided on account of time. In dealing with this subject in another paper, it was considered under two heads: first, the change observed in normal tissue; second, in abnormal tissue; and the conclusions reached at that time seem to still hold good. That no single form of degeneration alone is characteristic to the x-ray, and the form of degeneration observed depends entirely upon the tissue exposed and the method of x-ray application. Here may be seen the scope of this study and the cause of the great difference of opinion that exists among various authors. In some ways the effects of the x-ray might be compared to fever, as for instance in a case of high fever the first degeneration that usually takes place is a hylogranular, then, if the temperature continues, a fatty change follows. The recovery here depends upon the amount of damage done before the fever subsides. In another case, where the fever is continued for a long time with remission and intermission, we have the more chronic forms of degeneration, such as the amyloid change, etc. The x-ray is capable of the same latitude. Those who have watched an x-ray tube in operation and noticed how the vacuum will change from time to time will wonder how any constant result can be obtained, but the operator after a little practice will be able to judge to a great extent about how much energy a certain lamp is capable of giving under certain circumstances.

Then again, with this wide variance of x-ray energy, we have a still more important irregularity to consider, and that is the tolerance of the x-ray by certain individuals always being on guard for that person who has a frightful susceptibility to unpleasant effects. And what seems still more extraordinary is the fact that a person will tolerate a certain amount of x-ray from one apparatus, while apparently the same amount from another will cause trouble. No doubt this is due to our imperfect methods of measuring the amount of x-ray energy. Some have thought that the so-called "brush effects" have a great deal to do with these unexpected results, but if this is so it seems queer that we have not seen these changes before in other fields, but this subject still needs some careful study.

The effect of the x-ray upon tissue must differ from anything else, for the reason that it penetrates to such a depth, and diverges as it does so; therefore a greater area is covered below than upon the surface, while its energy is only modified by the distance from the source, and the resistance of the intervening tissue. The question of how the x-ray acts must be overlooked for the time being, unless we accept the explanation that it is an electrochemical disturbance of the ultimate cell elements.

The inflammatory effects of the ray upon the tissues of the body have been termed a "burn." Although some objection has been raised to its use, it seems to fill the sense in this instance, just as when used for an ulceration caused by some chemical. This effect may be so slight as to cause only a perceptible reddening of the skin, followed by a faint tanning;

\* Read before the American Roentgen Ray Society, Philadelphia, December, 1903.

there is very little local disturbance, with no systemic effects. From the work of some German authors in this field it would appear that this process closely resembles sunburn, but the effects are much deeper. In the case of severe burns, the process is unique in itself and differs from all other forms of degeneration and regeneration, although very irregular in its course. The period of incubation may be from a few hours to months, and during this time the patient may complain of severe pain in the affected part. In some instances the pain may be quite severe, but intense pain does not necessarily mean a severe burn; in fact what might be termed a mild burn often produces the most discomfort. The general systemic disturbance in these cases are quite as irregular but in a general way follow the course that might be expected from ordinary ulcerations in the affected part. The first observation is that of a surface hyperemia, which is followed in a few days or even longer by a slough which gradually extends over the whole involved area. Its appearance is deceptive; it looks as if it could easily be removed, but on the contrary it is quite adherent; however, after a given interval, part by part will separate and, as these pieces are removed the underlying structures have the appearance of healthy granulation tissue, but in a few days another slough will form. This process will sometimes continue for months. The appearance of the slough is like that of a bad scald, it is usually moist but differs from it in the fact that it is extremely hard to remove and will often cause intense pain. The explanation may be this, in the case of a scald the tissue dies en masse and separates en masse, while in the case of the x-ray burn the cell necrosis is only one cell at a time, the living and dead cells are intertwined, no doubt that many of these cells would

recover if their nutrition was not impaired by these surrounding dead cells, and, acting like any foreign body, would also cause pain.

When the slough of an x-ray burn is carefully removed it gives the appearance of a highly magnified trabecula or a honey comb. The line of demarkation usually seen in other forms of gangrene are practically never seen here, and even when the ulceration has greatly diminished in size by healing, these sloughs still continue to form. The scars of these burns are curious, in very severe cases where the deeper structures are involved they resemble those from fire, but the surprising fact is that when the ulceration does not go below the superficial structures practically no scar will be formed and in a month or two after the ulceration has healed the skin will be as soft and as pliable as that which surrounds it.

At this point it would be well to call attention to a membranous deposit that forms over moist ulcerated surfaces, when the x-ray is applied over a long interval of short exposures, producing only a slight amount of reaction; from its appearance it would suggest diphtheria, except that it is whiter and not so dense, although when it is removed it leaves a bleeding surface. It closely resembles the slough of a bad burn, only that the membrane is entirely superficial.

As is well known, these x-ray burns are extremely painful in most cases, yet at the same time in some instances the x-ray will relieve pain, even anesthesia of the exposed part has been observed. Several theories have been advanced in explanation of these facts, but so far we have no substantial proof. In the case where anesthesia is produced after x-ray exposures where no pathological process exists, the explanation might be that there is a temporary degeneration of the terminal



nerve filaments which causes an impairment of function. This can hardly be offered as an explanation in the case where the pain is relieved in cancer, yet it will be noticed that if these cases receive too much x-ray treatment they will suffer pain, but of a different character from the pain before treatment. These facts, however, would suggest that the effects of the x-ray must be upon the cell elements in the exposed parts. In other words, when a cancer is being treated and the x-ray is applied in sufficient quantity to relieve pain, there will be very little disturbance of the part; on the other hand, when too much x-ray treatment has been given, an active inflammation follows, which involves outside structures and pain in consequence.

The study of the effects of the x-ray upon tissue microscopically in all instances offered here has been upon pre-existing disease. It has not been my fortune to be able to procure a case of simple burn, and in most instances these cases object to the knife, therefore this study is doubly tedious. Some facts have been brought forward that seem to hold good in normal and abnormal cases, but on the other hand there still exists a great deal of mystery that seems almost impossible to explain; take, for instance, a malignant growth surrounded by healthy tissue, it is exposed to the x-ray and it simply melts away, there is very little disturbance of the surrounding tissue, not only macroscopically but microscopically as well, this is well illustrated by the following cases:

CASE I.—Mrs. X. for several years has been suffering from an epithelioma of the face just above the alæ of the nose; it was at the time of treatment about the size of a five-cent piece. A section was taken from the edge of the ulceration just before the first treatment, and the microscope confirmed the clinical diagnosis. X-ray

treatments were given three times a week, from an 18-inch coil, on a 110-volt current, at 3 amperes, the vacuum of the tube was about 5 inches spark gap, the tube being 10 inches from the patient and time of exposure 10 minutes, the fluoroscope showed only a dull shadow of the hand. After the sixteenth treatment another section was removed from the edge of the ulceration, which at this time had healed to about one-third its former size. During the process of healing literally no reaction of the surrounding skin was produced and upon examination of the section very little difference could be seen except for some slight degeneration of the cells, otherwise it was a typical epithelioma, and a few weeks later, after the ulceration had healed, sections showed simply typical scar tissue. About the same observation was made in the case of Mr. S., which will be mentioned later.

Although in the reports of cases there is a wide difference of opinion as to the kind and degree of degeneration, many authors, however, speak of the vascular changes and most of them seem to agree that there is a thickening of the vessels, as was observed in the following case:

CASE II.—Mr. P., carpenter, thirty-four years of age, spindle-cell sarcoma of the leg. About five years ago he noticed a small tumor over the tibia about four inches above the malleolus; at first it did not annoy him, but as the tumor grew it became painful. He refused a radical operation, but about three months before he began x-ray treatment, the mass was removed. At that time it was about the size of a split baseball, the wound did not close satisfactorily and recurrence was very rapid. At the time he began x-ray treatment several nodules about the size of marbles existed along the line of a very indurated and excavated scar, which was about  $2\frac{1}{2}$  inches long. They offered

what would seem to be an ideal case for tissue study and it was the intention at that time to remove these nodules at intervals of every two weeks, but under daily treatment they disappeared in less than three weeks and only one nodule was removed on the ninth day. The x-ray was from a 15-inch coil, 6 storage cells, a Queen tube at about a 4-inch vacuum, the tube was about 10 inches from the patient and each treatment lasted about ten minutes. It should be said here that the ultimate result was not as favorable as might have seemed, for it recurred six months later and the man discontinued treatment. The reason for removing the section before the fourteenth day was due to the great softening and diminution to almost half the original size; there was at this time considerable erythema of the overlying skin. The sections showed considerable cell degeneration with invasion of leucocytes and a thickening of the vessels with deposits on the inner surfaces. The amount of degeneration did not seem to be in accordance with what might be expected. The vascular disturbance here was rather interesting, in a part that was rapidly diminishing, the vessels were thickened and in places were almost closed by cellular deposits, yet in the other cells there was a retrograde metamorphosis. The plugging of the vessels might explain the formation of these gangrenous patches after x-ray exposures, yet if this was the only cause, the degenerating process might be expected to subside sooner than it does, at the same time we should expect other embolic complications. Perhaps these cases of pneumonia that have followed x-ray burns are due to this cause.

In another case of epithelioma of the face (Mr. S.) of thirty years' duration, sections were examined from the edges of the wound, the first section was taken after the first treatment and the other

about three months later. There was very little difference between the two sections although the ulceration had closed in considerably. But while this was occurring another curious process had developed over certain areas, particularly in the deeper portions, there appeared a quite prolific growth of granulation tissue, of a pinkish color, much the same appearance that this tissue presents around tuberculous sinuses which have just been well washed with peroxide of hydrogen. Microscopical examination simply confirmed the clinical observation.

The examination of three sections from a rapidly degenerating epithelioma of the chin showed very little difference between the different sections. They were taken from the edge of the ulceration, the disease occurring in a man forty-six years of age. The x-ray in this case failed to produce any improvement, in fact it seemed to produce more irritation.

At this point it would be well to consider some of the work that has been done in this field and it will be noticed what a wide variance exists in their summaries.

Sequeira states that two definite effects from the x-rays are observed by the microscopical examination; first, a destruction of the epithelial cell, the nucleus and protoplasm undergoing lysis; in some cells there was a definite fatty change. Second, a stimulation of the connective tissue elements causing the formation of healthy scar tissue. Walker, in sections from a rodent ulcer, healing under the influence, found that a fibro-myxomatous degeneration was taking place. Beck found a colloid change in an adenocarcinoma. McCaw found the same change in an epithelioma of the uvula. Ellis summarizes from the microscopic examinations of four cases: First, necrosis of cells and trabeculae of varying degree. In Case I there was also marked fatty degeneration,

fewer areas of lymphocytic infiltration in one case after exposure, about equal numbers in the others, a tendency to occlusion of the vessels by deposits on their inner surfaces, practically entire absence of infiltration by polymorphonuclear leucocytes.

In regard to this last point, Dr. Ellis's observations are rather interesting, from the fact that he has given this point very careful study. Mayou, in contradistinction to the above and like most other observers, found a large number of leucocytes, but differs from most others in the fact that he observed that the vessels were dilated. In another instance of a large tumor that had greatly diminished under the use of the x-ray, no change was noticed that could be attributed to its use.

Stewart, assisted by Nickerson, Wilson and Man, made an exhaustive study of a case of epithelioma of the hand and came to the following conclusions: (1) It is probable that when epitheliomata react favorably to the x-ray treatment that characteristic histological changes will be found: (2) the important early changes are fatty degeneration and vascularization of the epithelial pearls; (3) leucocytic infiltration and various degeneration processes complete the destruction; (4) bodies indistinguishable from Plimmer's bodies multiply as epithelia degenerate.

When comparing the above results we find them directly opposite to those of Dr. Ellis, and the reason is due to the different clinical methods used in the x-ray treatment. In the case of Dr. Stewart no doubt there was some x-ray reaction, that is, an over-action, while in the cases of Dr. Ellis there was no great amount of reaction. This fact will be noticed in the difference between the cases of Mr. P. and Mrs. X., and Mrs. S., and leucocytes might be looked upon to hold the following position: First, that they will be ob-

served where we have an overstimulation of the parts by the x-ray; second, in cases that show no reaction leucocytes will not be observed. Allen, however, concludes that leucocytes are increased in the exposed areas immediately.

Some other points in Stewart's paper need careful attention. He refutes the statement of Unna that epitheliomata never undergo a fatty change, and as to the vascular changes he observes marked evidence of the formation of new blood vessels, noticeably in the centers of the epithelial pearls. His specimens showed no signs of an obliterating endarteritis.

Pernet examined tissue from a case of lupus vulgaris, which six months previous had received about fourteen treatments about ten minutes each and given daily. He found the collagium disjointed and to some extent disintegrated, the elastin had been destroyed. The hair follicles and sebaceous glands had also disappeared, while the sweat glands showed surrounding infiltration and degeneration. A large vessel in the subcutaneous stratum showed thickened walls, and in places the upper layer of the corium showed a fibrous change.

From the above observations one would naturally expect considerable disturbance of the normal tissues, when they cover some deep growth that is being treated, especially so in the case of abdominal tumors, yet in many instances have large inoperable masses been treated, until complete absorption has taken place, and with very little disturbance of the overlying skin; no doubt that some change does take place, but it never seems to lead to any grave consequences.

The opinion has been expressed by some that all cases of malignant disease should be treated until considerable reaction is observed, but this intense reaction is not necessary, for in fact, when these



cases react favorably to the x-ray they will usually do so with very little disturbance of the surrounding structures, and over reaction will only lead to a necrosis of the tissues and the healing process will be delayed while the patient will suffer more pain. In some instances it has been looked upon as the cause of recurrence of the disease. Some operators advise the use of the ray until a severe burn has been produced, with the idea that it will have a good effect in retarding metastasis; this has not proved to be so clinically and when one considers the natural history of these cases, this idea is absolutely lacking in support, when we consider the limited area treated, and then, how early and how distant these metastatic processes have been found in the normal case. Sections from the case of K. G. were made from a nodule under the right axilla, the original scirrhus was of the left breast.

Another false idea exists regarding the prognosis of deep and superficial growths, the last are supposed to be much more amenable to treatment: the fact is, however, it is not the location of the disease but the form. The natural course of a superficial skin carcinoma is often thirty years; commonly fifteen years. Now compare this with the rapid progress of a breast or gastric carcinoma and an entirely different aspect presents itself; in these cases the primary process may be treated with success when a secondary process is discovered, and in rapid suc-

cession others follow, until the patient succumbs of exhaustion. Slow-growing deep growths have done well under x-ray treatment, while on the other hand, rapid-growing superficial growths will often be irritated.

It would be impossible to review in detail all of the different phases of this subject and discuss them, but from what has been given the conclusions might be as follows: First, that no single form of degeneration is alone characteristic to the x-ray, and that the form of degeneration observed depends entirely upon the tissue exposed and the method of x-ray application; second, it would seem that the effect of the x-ray was upon the cell elements in the exposed parts, but why certain normal cells, such as those in hair follicles, etc., should be more susceptible than other tissue is still a question of doubt, but in lieu of the vascular disturbance found by many observers it might be thought that this cause plays an active part.

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**American Electro Medical Society.**

Titles and abstracts of papers for the meeting of this society at Chicago in December next may be sent to the chairman of the executive committee, Dr. H. P. Pratt, 1207 Masonic Temple, Chicago.

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Tuesday—Electro-physics, 10 to 11; mechano-therapy, 11 to 12; hydro-therapy, 12 to 1.

Wednesday—Electro-physics, 10 to 11; mechano-therapy, 11 to 12; electro-diagnosis, 12 to 1.

Thursday—Electro-physics, 10 to 11; electro-therapy, 11 to 12; electrolysis, 12 to 1.

Friday—Electro-physics, 10 to 11; electro-therapy, 11 to 12; electrolysis, 12 to 1.

Saturday—Thermo-therapy, 10 to 11; electro-therapy, 11 to 12; practice, 12 to 1.

For the weeks beginning October 10, November 7, December 5.

Monday—X-rays, 10 to 11; radiography, 11 to 12; radio-therapy, 12 to 1.

Tuesday—X-ray tubes, 10 to 11; radiography, 11 to 12; radio-therapy, 12 to 1.

Wednesday—Localization, 10 to 11; radiography, 11 to 12; photo-therapy, 12 to 1.

Thursday—X-ray diagnosis, 10 to 11; high frequency, 11 to 12; psycho-therapy, 12 to 1.

Friday—Radium, etc., 10 to 11; high frequency, 11 to 12; psycho-therapy, 12 to 1.

Saturday—X-rays, 10 to 11; jurisprudence, 11 to 12; psycho-therapy, 12 to 1.

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**Improved Board of Health.**

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"Composed of scientists, I presume?"

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"Physicians, perhaps?"

"Not much. We don't allow doctors on our Board of Health—no, sir—nor undertakers, either."

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## Errors in Diagnosis of Ureteral Calculus.

BYRON ROBINSON, B. S., M. D., CHICAGO.

In this brief note I wish to present a case which with the x-ray led to an erroneous diagnosis. A man forty-six years of age came from an adjoining State to consult me in regard to an illness which had afflicted him for some fifteen months. For the past eight months he had been unable to work. He had lost considerable flesh. Physical examination revealed no palpable abdominal lesion. Appetite was defective. Urinalysis demonstrated pus, granular casts, epithelium. Vesical in-

spection revealed gonorrheal cystitis of a severe type. The bilateral ureteral catheterization could be accomplished for two and one-half inches only. In drawing the catheter from the ureter the ureter grasped the catheter so firmly that the ureteral orifice followed it in the shape of a cone. A severe endo-ureteritis existed. After complete evacuation of the tractus intestinalis two Roentgen pictures were taken. Each showed three distinct shadows with definite location, dimension and contour along the left pelvic ureter. The patient was carefully prepared for operation for five days by draining the tractus intestinalis and tractus urinarius. Dr. Gustav Bergner who was in consultation during the catheterization was associated with me in the operation. I incised the abdominal wall from the pubic spine to the anterior superior spine of the ilium parallel with Poupart's ligament. The external and internal oblique and transversalis muscles were divided as well as the fascia abdominalis. The ureter is easily followed by securing it dorsal to peritoneum at the point it crosses the vasa iliaca. The ureter is closely applied to the external surface of the peritoneum by a few tissue fibers. It must be remembered that the ureter is nourished by a solidly compact vascular anastomosis which is formed by the renal, ovarian or spermatic arteries, the arteria ureterica media from the iliaca and the arteria ureterica distal from the uterine, as well as branches from the vesical, vaginal and hemorrhoidal. This compact vascular anastomosis extending from the proximal to the distal end of the ureter enables the ureter to be safely isolated from the peritoneum for several inches so long as the ureteral vascular anastomosis is not dis-

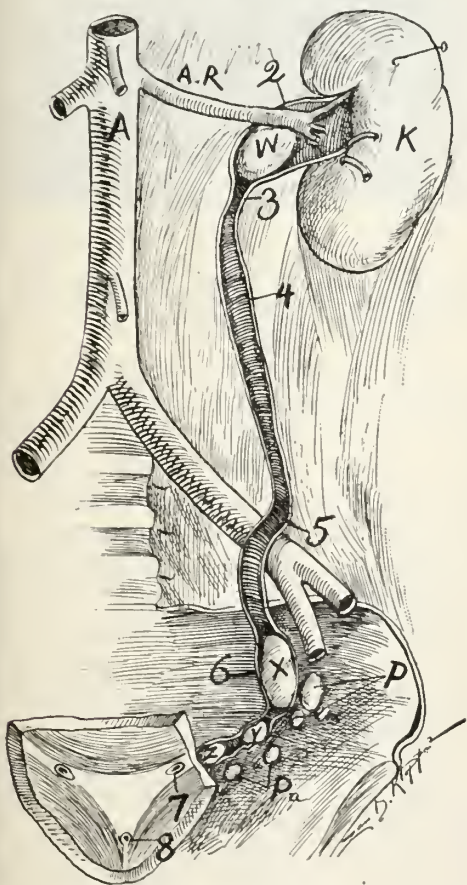


Fig. 1.—Cut to illustrate the common location of ureteral calculus (W, Y, Y, Z). Also P and Pa indicate the location of the phleboliths found in my case. At P two small and one large phlebolith are noted. Pa shows two small phleboliths.



turbed. The isolated pelvic ureter is thus safely palpated. To our surprise the pelvic ureter did not contain palpable ureteral calculi.

However, the problem was distinctly solved by finding in the exact location and course of the ureter indicated by the Roentgen ray three phleboliths distinct in contour, dimension and location. The phleboliths were easily located and removed. After removal they were exposed on an x-ray plate and presented shadows as definite in contour and dimensions as the original shadows. The patient made an uneventful recovery and was in good condition four weeks after the operation. The lesson to be learned in this case is that phleboliths which are not of unfrequent occurrence in the pelvic veins will cast a shadow of distinct contour, location and dimension. The phlebolith casts a shadow of more definite contour and location than the ureteral calculus. Besides, the phlebolith's shadows are liable to be bilateral though in unequal numbers on each side. Since the error pro-



Fig. 2.—Represents an x-ray photograph of the subject presenting pelvic phleboliths situated adjacent to the ureter distinct in contour, dimensions and location, as indicated bilaterally by the hands. These phleboliths should be reversed, the three phleboliths belong on the left side.

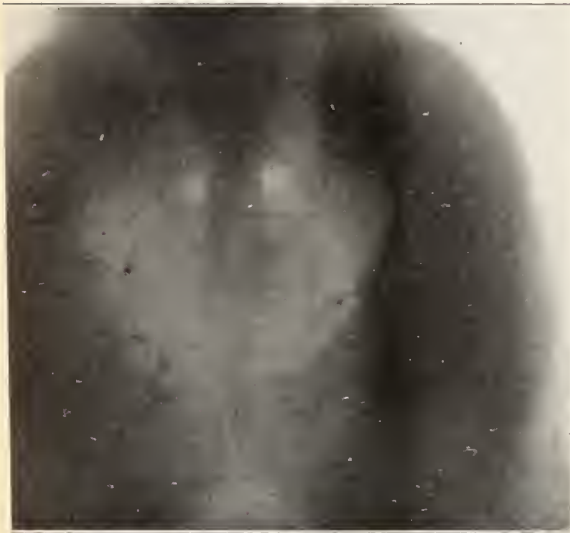


Fig. 3.—Represents three distinct phleboliths on the right side in a patient.

duced in my case by the phleboliths Dr. Robert S. Gregg, who has performed my x-ray work in Dr. Pratt's laboratory for years, secured an x-ray from a patient with some ten shadows of phleboliths, which is also here presented. Some experience with x-ray work will enable one to differentiate between skiagraphs of a phlebolith and of a ureteral calculus. The x-ray is an epoch-making advance in the diagnosis of ureteral calculus. However, we have learned more from our error due to the phlebolith than from ten correct diagnoses of ureteral calculus.

We are sorry for the inconvenience that our erroneous diagnosis caused to the patient: however, it was the price of progress.

### The Treatment of Cancer With X-Ray.

(P. v. Bruns, *Therapie der Gegenwart*, No. 1, 1904.)

The results of treatment show that cutaneous canceroids and cancers of other organs differ decidedly.

Cutaneous canceroids, especially rodent ulcers, are most amenable to x-ray treatment, as results are quite favorable and the scars obtained are nicer than from any other treatment. The patients are exposed to the rays thirty to sixty minutes in three to five applications. During the first ten to twelve days the ulcer becomes darker and secretes more. After twelve to fourteen days a slight erythema of the surrounding skin develops, the hard wall softens and shrinks, the ulcer fills with granulation tissue, and soon new skin covers it from the periphery. Complete recovery occurs in four to eight weeks; however in a number of cases recurrences have been observed.

Carcinoma of deeper-seated organs so far have not been cured, but a number showed an improvement after x-ray treatment. Many cases of mammary cancer were treated with x-ray, in most of which the tumor was diminished in size and the life of patient prolonged.

The proper length of time of exposure is hard to determine, as no immediate subjective or objective symptoms of over-exposure usually manifest themselves. These occur from eight to fourteen days after exposure.

The characteristic changes in cancer tissue resulting from x-ray treatment are degeneration and total destruction of the cancer cells. Perthes explains the change as a confluence of the cell protoplasm in one mass with vacuoles, and the nuclei degenerate. Cell infiltration and new

connective tissue invades the cancer tissue from the periphery and gradually replaces the cancer cells.

Scholz's experiments of x-rays on normal skin show that the epithelial tissue is primarily affected and degenerates, while the connective and other tissues suffer much less. Cancer cells are more sensitive to x-rays than are normal epithelial cells.

The author concludes that the majority of carcinomata are not benefited by x-rays, that subcutaneous carcinomata are benefited by x-rays, and that cutaneous canceroids are cured by x-ray.

The technic must be improved so deeper-seated tissues can be reached. Only such cases should be treated with x-rays in which no harm would be done by postponing a surgical operation, i. e., the most favorable and unfavorable cases, and rodent ulcers. Inoperable mammary carcinoma are benefited, as the pain diminishes, the odor is less offensive, and the tumor grows less quickly.—*Med. Fortnighlly*.

### The Bloodless Treatment of Phimosis.

(Gerson, *Therapie der Gegenwart*, February, 1904.)

The prepuce is pulled over the glans with left index finger and thumb, after which a dull pincette with closed branches is introduced into the sack. The pincette is permitted to spring open, which dilates the prepuce. This process is continued for one-half to two minutes daily, and in several weeks a cure is produced. The mother is instructed to dilate the sack twice daily by pulling prepuce apart with index finger and thumb of each hand. This method is available only in infants and children.

**Some of the Physical Properties and Medical Uses of Radium Salts; with Report of Forty-two Cases Treated by Pure Radium Bromid.**

Francis H. Williams, *Medical News*, February 6, 1904, states that radium has five properties that especially deserve notice: (1) It maintains a temperature above its surroundings under thermal insulation: a temperature of  $1.5^{\circ}$  C. has been observed. (2) It is luminescent. (3) It is a spontaneous source of electricity. (4) It gives out three kinds of rays, named by Rutherford, alpha, beta and gamma. (5) It produces in surrounding objects "induced radioactivity," or "excited radioactivity." This imparted radioactivity is caused by an emanation. The emanation, which is thought to be a gas, imparts radioactivity to objects that have been in the neighborhood of radium salts for a sufficient period: that is to say, these objects, even after removal from the radium, give out rays for a certain length of time. On account of their inability to show sufficient differentiation between the tissues, the rays from radium, unlike the x-rays, can not be used for diagnosis, or prognosis, either by means of radiographs or of the fluorescent screen. Therefore for these purposes they can not replace the x-rays. The use of radium salts for therapeutic purposes needs much the same kind of experience as is required for the successful therapeutic use of the x-rays. Already a number of cases of injury to persons working with radium have been reported. Radium should be kept in a metal box or capsule with a thin mica front or other suitable covering, so that the radiations may be cut off in all directions except that in which the practitioner desires the rays to proceed. To such a capsule the writer has attached a long, flexible handle, in order to hold the radium at a distance

when applying it. This handle is a protection to the physician. When not in use, the capsule should be placed in a thick lead box or tube, so that the radiations may be absorbed. An over-exposure may cause a burn, which may not become evident for some time. Exposures differ for different diseases, even superficial ones. Consequently experience is necessary to judge of the proper length of exposure and of its frequency. In conclusion the writer says that his experience thus far teaches him that there is much similarity between the action of the radiations from radium and the x-rays; that if the results obtained by radium prove permanent, this new therapeutic agent will be largely used instead of the x-rays, but that the two will supplement each other. Certain diseases promise to yield more readily to treatment by radium and others to the x-rays. A disease that has attacked different parts of the body of a given patient may be better treated in certain regions by radium and in others by the x-rays. It is quite possible that in some cases the two remedies used together on the same area and at the same sitting may accomplish better results than either alone.

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DR. WILLIAM J. MORTON

Chairman of the Electro-Therapeutic Section of the International  
Electrical Congress, 1904.

# THE AMERICAN X-RAY JOURNAL

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VOL. XV.

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## The Principles of Electro-Therapeutics.

BY DR. T. PROCTOR HALL.

A paper presented at the International Electrical Congress of St. Louis, 1904.

From the known physical, chemical and physiological effects of electric currents it is possible to draw fairly accurate conclusions as to their therapeutic uses; and when these data are combined with the results of clinical investigations, the principles of electrotherapeutics are set forth ready for application for the relief of mankind.

### ELECTRIC CURRENTS.

It is essential that the practitioner should have first a clear concept of the nature of an electric current. For this purpose the Vortex theory of electricity and magnetism offers the simplest working hypothesis. According to this theory an electric current is a vortex ring, consisting of a bundle of chains of polarized and rotating atoms, each chain forming a complete circuit. Any substance, such as copper, which permits of the rotation of its atoms in such polarized chains is called a conductor. A substance, such as quartz, whose atoms are so firmly fixed in their relation to each other that no such continuous rotation is possible, is called a non-conductor.

By an electromotive force, which, according to this theory, is a polarizing and rotating force, the atoms of any substance may be rotated to some extent. In a non-conductor the extent of the rotation is in direct proportion to the force applied, and

is therefore determined by the magnitude of the electromotive force.

The rotation of the atoms at the surface of a nonconductor is necessarily conveyed in part to the adjacent atoms. This capacity for conveying an electric strain through its substance is known as dielectric capacity. The dielectric capacity of glass or mica is several times as great as that of air; in other words, the effect of an electromotive force is much more pronounced thru a millimeter of glass or mica than thru a millimeter of air. The dielectric capacity of a good conductor is almost infinite; in other words, the conductor conveys an electric strain from atom to atom with practically no loss.

If we assume that the right-handed rotation of a chain of atoms constitutes a positive current, then a left-handed rotation is a negative current. It will be observed, however, that a rotation which is right-handed to one person is left-handed to the one who stands facing him. The same current (rotation) is therefore at the same time both positive and negative, according to the point of view. The difference between a positive and a negative current is relative only.

The direction of a current of low potential may be found in several ways. If the current passes near a magnetic needle which is free to turn, the north-seeking



end of the needle tends to point in the direction of the atomic rotation near it. If two common sewing needles be inserted into a piece of beef, half an inch or more apart, the anode needle sticks fast and the kathode needle dissolves the surrounding tissues and becomes very loose. The direction of an intermittent current of high potential, such as is obtained from a static machine, may be determined from the appearance of the spark. When the spark gap is small, the spark has a short white streak at the kathode, a long white streak at the anode, and a fainter violet line across the middle. When the electrodes are far apart the spark appears to branch from the anode or positive pole, which forms the trunk, and the branches, after disappearing, seem to re-collect into a heavy white streak a short distance from the kathode. In either case the spark will follow a pointed stick which is moved across its path close to the anode, while it pays very little attention to the same stick moved across at the kathode.

A direct current is one whose rotation is in one direction only. If the direction of the rotation is periodically changed, the current is alternating. These, the direct and the alternating, are the two main classes of currents.

If some of the atoms in a polarized chain belong to a nonconductor they are unable to take part in a continuous rotation, consequently the chain can not rotate, and there is no current. But if the electromotive force is sufficiently great the nonconducting atoms may be torn from their associations and compelled to rotate. The nonconductor is in this way pierced or broken, and the sudden expenditure of energy usually gives rise to a perceptible amount of heat and light.

This phenomenon is called a spark discharge.

If the electromotive force is not great enough to cause a spark, the atoms at the surface of the nonconductor remain strained further than those in the interior. This strained condition of atoms at the surface is called an electric charge. It will be noticed that the strain on one side of the nonconductor is right-handed, forming a positive charge, while the strain on the other side is left-handed, forming a negative charge, the observer being supposed in each case to face the surface under consideration. The absolute direction of the rotation is of course the same on the two sides.

If the original electromotive force be removed the strained atoms return to their normal position, and in so doing produce a current in the opposite direction. The positive charge, which was produced by a positive current passing toward the surface, produces a positive current from that surface, and similarly with the negative charge.

Along the sides of the rotating chains of atoms the elastic ether (which may be thought of as a soft solid) is displaced to a slight extent in the direction of the rotation. This displacement is magnetism. From the sides of an alternating current proceed magnetic waves which are plane-polarized. From the end of a conducting chain of atoms which are subjected to an alternating electromotive force proceed cylindrical waves which have all the essential characters of waves of ordinary light.

The rotating atoms in a conductor strike against each other and against other atoms, and impart to them an increase of vibratory velocity (heat). Some of the energy of the current is

thus wasted in a conductor. The proportion of energy so wasted depends upon the physical and chemical conditions of the conductor, and is a measure of the resistance of the conductor. If a pure metal were cooled to the absolute zero of temperature there would be no waste of energy in this way and the resistance of the metal would then be zero.

The commercial units used in connection with electricity are arbitrary. The unit of current (total amount of rotation per second) is the ampere. The current used in a sixteen-candle power incandescent lamp is about six-tenths of an ampere. One-tenth of an ampere is considered the limit of current which may be safely passed thru any vital portion of the body, for example, from one hand to the other, thru the chest. Therapeutic currents are measured in milliamperes, or thousandths of an ampere.

The unit of electromotive force is the volt, which is approximately the force of a single salammoniac cell or a dry cell after it has been used a little time. The usual voltage of an incandescent light circuit is one hundred and ten. The voltage of trolley circuits is about five hundred.

The unit of resistance is the ohm. The resistance of 260 feet (eighty meters) of No. 18 copper wire is one ohm. The resistance of fine wire is proportionately greater. One foot of No. 40 copper wire has a resistance of one ohm. The resistance of the human body varies from about five hundred ohms upward, according to the kind of contact made with its surface. Roughly speaking, the conductance of the various tissues is in proportion to the amount of water contained in each. The relation between these three elements, electromotive force ( $E$ ), current ( $I$ ), and resistance ( $R$ ) is shown by Ohm's Law, which is:

$$E=RI, \text{ or numerically,} \\ \text{Volts}=\text{Ohms} \times \text{Amperes.}$$

This implies that the current may be increased by increasing the electromotive force or by decreasing the resistance.

#### ELECTROLYSIS.

When an electric current is passed thru a liquid containing a salt in solution the end of the conductor from the positive (carbon or copper) pole of the battery is considered to be the road by which the current enters the solution (according to the fluid theory of electricity). It stands, therefore, at the source of the electric stream in the solution and is called the anode (up-road). The other electrode at the bottom of the stream is called the kathode (down-road) and is in direct connection with the negative or zinc pole of the battery. The molecules of the salt are polarized by the electromotive force, and one after another are split into two parts by the current. This splitting is called electrolysis. The two parts into which each molecule is split are called ions (wanderers). The splitting takes place in the same way as in the double decomposition of chemical salts, namely into a basic part and an acid part. The basic parts move in the direction of the positive current (down stream) toward the kathode, and hence are called kations. The acid parts move in the opposite direction (up-stream) toward the anode, and hence are called anions.

In the case of common salt ( $\text{NaCl}$ ) the sodium atoms are the kations and collect around the bathode; the chlorine atoms are the anions and collect around the anode.

In every case the direct effect of the current is to split the molecule into two and only two parts. But in many cases secondary changes take place, which are undoubtedly electrical in character but which are most conveniently considered

to be the chemical results of the unstable conditions formed by electrolysis. Metallic sodium decomposes water, setting free hydrogen gas and forming caustic soda:  $2Na + 2H_2O = 2NaOH + H_2$ . At the anode the chlorine ions may decompose water, forming hydrochloric acid and oxygen gas;  $2Cl_2 + 2H_2O = 4HCl + O_2$  similar changes take place with other compounds. The secondary reactions are all of the same character, and may easily be written down by one who has a knowledge of elementary chemistry. The metals and alkalis are cations; the acids radicles are anions.

The physiologic effects of a direct current are mainly in the vicinity of the electrodes. Since common salt is one of the most abundant of the salts in solution in the body, its behavior under electrolysis may be taken as a type of the changes produced by electricity in the tissues. Near the anode we have increased oxidization, and the hardening or stringent effect of the acid. Near the kathode we have deoxidization and the softening or dissolving of tissue by the alkali. Considering in particular the effect upon the smaller blood vessels, near the anode these are constricted and ischemia produced; near the kathode they are dilated, causing hyperemia. Pain usually results from pressure upon nerve endings, and in such cases relief can be obtained by the astringent effect of the anode. Defective nutrition in any part is frequently due to defective blood supply, and in such cases can be improved by the hyperemic effect of the kathode. Either the acid or the alkaline effect may be made so intense as to cause destruction of tissues. For the removal of dermal defects (warts, moles, nevi, etc.) either electrode may be used. The anode forms a hardened mass of coagulum and connective tissue. The kathode

softens and dissolves so that the abnormal growth is more readily removed by the lymphatics. The anode is therefore to be preferred where cutting off the blood supply is the essential part of the treatment, and the kathode where the removal of all traces of hypertrophied tissue is more important. The kathode is successfully used for the relief of urethral, rectal, esophageal and other strictures. A current so mild as not to produce any marked degree of inflammation is used repeatedly, and this gradually dissolves the constricted scar tissue.

| Kathode            | Electrodes<br>Molecule<br>Ions | Anode            |
|--------------------|--------------------------------|------------------|
| <i>Cations</i>     |                                | <i>Anions</i>    |
| Basic, metallic or |                                | Non-metallic, or |
| Alkaline,          |                                | Acid             |
| Relaxing,          |                                | Astringent,      |
| Softens and dis-   |                                | Coagulates and   |
| solves,            |                                | hardens.         |
| Causes hyperemia,  |                                | Causes ischemia, |
| Increases pain,    |                                | Reduces pain,    |
| Excites.           |                                | Sedative,        |
| Deoxidizes,        |                                | Oxidizes.        |

#### FORESIS.

The term *foresis* is applied to the motions of the ions when made use of to carry medicaments into some particular part of the body. The motion of metallic and basic ions toward the kathode is termed *kataforesis*, and the motion of the acid ions toward the anode, *anaforesis*. The amount of *foresis* is dependent upon the intensity of the current, and has no direct relation to the electromotive force, so long as the latter exceeds a few volts. *Kataforesis* has been successfully used for the destruction of malignant tumors and the sterilization of adjacent tissues by heavy currents from amalgamated zinc needles.

When the current is alternating, or



when the polarity is frequently changed, *foresis* takes place in alternate directions. The result, instead of being zero, is a scattering of both sets of ions throughout the tissues. Molecular diffusion then takes place much more rapidly than it would without the action of the current.

The remarks made up to this point regarding the polar effects of the electric current apply to direct currents only. When an alternating current is used there are no polar effects, provided the positive and negative portions of the current are symmetrical. The molecules are split into ions just as in the case of the direct current, but the ions have the opportunity of reuniting when the current is reversed. If the original molecules are stable under existing conditions this reunion takes place, leaving the chemical composition precisely as it was before. But such conditions are rarely, if ever, found in the tissues. The chemical changes by which the food is finally oxidized are constantly taking place. Electrolytic action facilitates these changes by assisting in the decomposition of molecules. Physiologically this means acceleration of metabolism. Therapeutically this stimulus is advantageous wherever metabolism is deficient, or where tissue debris has accumulated, or where local bactericidal infection occurs, or where abnormal growths are taking place. In all of these cases the completion of normal tissue changes removes the pabulum of pathological cells.

It is important in this connection to note that of the three essential life processes,—nutrition, metabolism and elimination,—the alternating current accelerates chiefly metabolism, and it is necessary to look closely after nutrition and elimination by other means.

#### SENSORY REFLEXES.

Some of the most marked effects of electricity upon the human body are produced through sensation. These effects are not peculiar to electricity, but they have been to a very considerable degree overlooked by other therapists. The involuntary muscular system maintains its tone in part by the reflex action of the unnoticed sensory impulses which are continually received through touch, hearing, sight, etc. If these mild and general sensations are increased in intensity, the reflexes become stronger. The blood vessels, for example, are constricted, raising the blood pressure, the heart beats more strongly, respiration is deeper and there is greater tension in every part of the organism.

Locally these reactions may be used to great advantage. In case of local hyperemia, in which there is abnormal distension of the smaller blood vessels, a slight increase in the sensory reflexes in that region is frequently sufficient to cause a return to their normal size, which stop exudation and cause reabsorption of the exudate. If coagulation has not yet taken place this reabsorption is very rapid. The necessary stimulus may be given by brushing the skin with a soft feather or a camel's hair brush, or by passing the finger tips over it very lightly, or by tapping gently with a light stick, or by the lips of the mother who may "kiss the spot to make it well," or by the spray or breeze from a static electric machine. Similar effects may be produced near the surface by an astringent wash, and at a considerable depth under the anode by the direct current. Using a mild breeze from the positive electrode of a static machine the sensory and polar effects are combined. Bruises, varicosities, rheumatic swellings and similar painful hyperemic

conditions are often promptly relieved by this treatment.

When sensations are greatly increased in intensity the normal reflex fails through overstimulation of the nerve centers. The effects are then irritating, the exact opposite to what they were before, resulting in a hyperemic condition of the part. This condition may be obtained electrically by any painful application of the current. It is advisable where hyperemia is desired to combine the chemical effect of the kathode with the sensory effect of the pain. Violent stimulation results in a condition resembling shock, in which the reflex almost disappears.

In some persons and in some abnormal conditions the senses are excessively acute; in others very dull. The sensory effects are dependent upon the amount of sensation and the condition of the nerve centers, and not merely upon the amount of force applied.

#### MUSCULAR STIMULUS.

Upon the neuro-muscular system electricity acts directly to produce muscular contraction. These contractions are mainly caused by changes in the intensity of the current, and the more sudden the change the greater is the amount of contraction. For muscular effects it is important that the current changes be not too rapid to permit of complete relaxation, otherwise the circulation is impeded by the contractions and no benefit results. In treating the nerves the current changes may be made much more rapidly. When the changes are very rapid, say 5,000 per second, the conductance of the nerve for ordinary stimuli is temporarily lost.

#### IDEATION.

By ideation or suggestion is meant the production or reproduction of ideas or concepts in the mind of the patient. While this can not be done directly by means

of electricity, the conditions of electric treatment are in most cases unusually favorable for it and it becomes, therefore, an important part of the treatment. Ideas suggested to the patient are consciously or subconsciously accepted by his organism if the organism is in a receptive condition. The essence of receptivity is the absence of resolution on the part of the patient. He may be in a condition of complete rest, or of nervous excitement, or of surprise; in all these there is irresolution, and suggestion is then effective.

In taking an electrical treatment the patient is introduced to apparatus that is strange and mysterious. He is outside of his usual conditions. His ordinary mental routine is interrupted, and his subconscious mental acts are subjected to new directions and impulses. In this bewildering maze he looks to one source, the physician, for safety and direction. A statement from his physician regarding the changes which are being induced in his organism causes an expectant attitude of the subconscious personality of the patient which materially assists in bringing about the desired changes. It is not necessary, in fact it is injurious, to go beyond absolute truth in giving these suggestions. They must be made clearly, confidently and repeatedly, in order to produce the best results. Probably one-half of the total effect of electric treatment in general practice is due to the sensory reflexes and suggestion.

#### RADIATION.

The x-rays are believed to be electric waves corresponding, to some extent, to waves of light. Clinical observation is in harmony with the view that the effects of waves of light and electricity are very like those of alternating electric currents, especially high-frequency currents. There is first the stimulating influence upon

metabolism. This may be mild, or strong, or destructive. In the second place there are the sensory reflexes already described. The treatment of abnormal growths by any form of electric wave is based upon the fact that as living organisms abnormal cells are less stable than normal cells. Consequently an irritation which is not sufficient to cause serious injury to normal cells may be strong enough to be destructive to abnormal cells. The essence of such treatment, therefore, consists in applying the stimulation so intensely as to cause gradual destruction of abnormal tissues, stopping short of serious injury to normal tissue.

If the abnormal tissues are of considerable size, as in pulmonary tuberculosis, large, malignant tumors and degenerative conditions of the blood or muscular system, there is danger of systemic poisoning by toxins formed from the diseased tissues by the radiations. The treatments must then be at first short and mild and increased slowly, while all the channels of elimination are kept free.

The form of radiation to be selected depends chiefly upon its power to reach the part desired. Sunlight and artificial lights penetrate the tissues to a slight degree and are, therefore, advantageous for surface treatment only. X-rays of low penetrative power, which are obtained from a low vacuum tube, can also be applied only at or near the surface of the body. Rays of high penetration which are obtained from a tube of high vacuum pass without difficulty thru the soft tissues and may be utilized for the treatment of deeper lesions.

Radiations that pass entirely thru the tissues are wasted. Only those that are stopped by the tissues do work there. Consequently the vacuum of an x-ray tube

must be so adjusted that its rays reach the part to be treated, but do not pass thru to any considerable extent. Then all the available energy is expended in the desired region. The more highly differentiated tissues, such as hair and sweat glands, are more quickly injured by x-rays than the less differentiated tissues.

The part played by electrons in electric treatment is not yet very clear. The general effects of radium emanations are similar to those of electric waves of low penetration.

#### SUMMARY OF EFFECTS.

The known effects of electric currents may be summed up as follows:

1. Heat.
2. Magnetism.
3. Radiation.
4. Induced currents.
5. Electrolysis and fœresis.
6. Neuro-muscular stimulation.
7. Sensory reflexes.
8. Ideation.

Heat is always produced in a conductor by an electric current, but the amount of heat is so small in comparison with the other effects that it may be neglected in therapeutics.

Around every current are magnetic strains of the ether. The effects of these upon the body are practically zero, except when the currents are alternating and the magnetism, therefore, constantly changing its polarity. Intermingling with these magnetic changes, and to a considerable extent identical with them, are induced alternating electric currents. Magnetism as a distinct factor in the treatment may consequently be disregarded, and the effects considered as due to the induced currents only.

Ether waves and streams of electrons exist almost everywhere. They undoubtedly play a large part in the ques-



tion of health and disease. The negative electrons, which are much smaller and more rapidly moving than the positive electrons, are of great therapeutic importance, but beyond this we can, at the present time, say very little of them.

Electrolysis takes place wherever an electric current exists in a solution. Fore-sis always accompanies electrolysis. With direct currents the polar effects are very pronounced; the interpolar effects relatively insignificant. With alternating currents the electrolysis loses its polar character and becomes metabolic stimulation, and fore-sis becomes an assistance to molecular diffusion. These two processes accompany all forms of electric waves and are characteristic of sinusoidal currents, high-frequency currents, x-rays, light and radiant heat.

There is nothing magical or mysterious about the therapeutic effects of electricity. In the physical world there is no form of energy that is more capable of adaptation to all conditions. In therapeutics, also, a great variety of effects may be obtained at the command of the operator. Elec-

tricity, therefore, is not in any sense a specific for any disease, nor, on the other hand, may it be considered a cure-all. It is merely an exceedingly valuable physical agent, which, when applied intelligently and with the proper understanding of the human organism, can be depended upon for certain and definite results. The force applied can be exactly measured; the result can be foretold with certainty, so far as the electric side is concerned. Some uncertainty remains and always will remain on the side of the patient. The skill of the physician is constantly required to determine exactly the pathologic condition and recuperative power of the patient, and to judge of the form and extent of the curative agent best suited to his condition. The time has gone by when the physician is justified in using electricity alone in any of its forms for the purpose of determining its effect. The general nature of these effects has already been determined. The physician's duty now is to acquaint himself with them and to use them together with all other available measures to benefit his patient.



#### **American Electro-Medical Society.**

The second annual meeting of this society will be held at the Masonic Temple, Chicago, December 1 and 2, 1904. The committee of arrangements consists of Dr. Stuart Johnstone, Dr. J. A. Robinson, Dr. John E. Gilman, Dr. O. W. McMichael and Dr. Joseph R. Hawley.

The officers for 1904 are as follows: President, O. Shepard Barnum, M. D., Los Angeles, Cal.; vice-presidents, T. Proctor Hall, M. D., Ph. D., Heber Roberts, M. D., Milran K. Kassabian, M. D., H. C. Bennett, M. D., M. E., S. D.

Greenwood, M. D., J. Mount Bleyer, M. D.; secretary, T. Proctor Hall, M. D., Masonic Temple, Chicago; treasurer, O. W. McMichael, M. D.; chairman of the executive council, H. Preston Pratt, M. D.

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# The Action of the Constant Current on the Vitality of Microbes.

BY DR. S. SCHATZKY.

A paper presented at the International Electrical Congress of St. Louis, 1904.

In my work, "Biological Data Relative to the Treatment of Acute Inflammations,"<sup>1</sup> it became possible to explain, by facts already determined in science, my observations on the favorable action of the current in local inflammations, that the current through increase of the local nourishment strengthens the resistance of the cellular elements against the harmful agent, of whatever nature the same may be. I also was able to explain the healing action in tuberculous treatments,<sup>2</sup> partly through the increase in resistance of the cellular elements against the action of the tuberculosis bacilli, and through the elimination of the inflammation phenomena following these processes, caused by the participation of other microbes.

In order to more fully grasp the action of the constant current in inflammations of a microbe origin, I found it necessary also to learn its direct influence on the microbes themselves. I have devoted the present paper to this question.

Although this matter is of great importance, it has hitherto been discussed very little. The literature on the subject is very limited. Of the few authors who have published their observations in this direction, not one has so combined his experiments that they accord with the galvanization employed for therapeutical purposes. Krüger,<sup>3</sup> for example, galvanized microbe cultures, in the course of 24 to 30 hours, with a current of a strength

up to 20,000<sup>4</sup> milliamperes. Apostoli and Laqueriere<sup>4</sup> employed a current of 50 to 300 milliamperes for only five minutes, and directed their observations mainly on the effect of the positive pole. Cohn and Mendelsohn<sup>5</sup> employed currents of very small pressure of from 2 to 12 volts, etc.

However important the results of such experiments may be in a theoretical way, they present only a moderate interest from the practical standpoint. In order to define the advantages or disadvantages of the action of the constant current on microbes in its therapeutical application, it seemed rational to me to make the experiments in a manner approaching as closely as possible to the mode of application in therapeutics. I, therefore, endeavor to remain within the limits employed in therapeutics, both as regards power and duration of galvanization. I did not fix my observation on the polar action of the current, but on the phenomena which it exercises on the vitality of the microbes in the interpolar space. The following observations caused me to do this:

1. The actions of alkalis and acids on the vitality of microbes are sufficiently well known in bacteriology. We can, therefore, conclude, independently of experimental research, as to the specific influence of the poles, which corresponds to their chemical nature.

2. As the seat of inflammation always attacks, more or less, a part of the thick-

1. *Comptes Rendus of the Second International Congress of Medical Electricity at Bern, 1902.*

2. S. Schatzky: "The Constant Current as a Cure for Tuberculosis," *Comptes Rendus of the Second International Congress of Medical Electricity at Bern, 1902.*

3. Krüger: "Ueber den Einfluss des Konstanten Stromes auf Wachstum und Virulenz der Bacterien" (*Zeit f. Klin. Medicin.*, XXII, 1893).

4. Apostoli and Laqueriere: "De l'action polaire du courant galvanique constant sur les microbes et en particulier sur la bacterie charbonneuse," *Comptes Rendus Ac. Sc.*, Vol. 110, 1890.

5. Cohn & Mendelsohn: "Ueber die Einwirkung des elektrischen Stromes auf die Vermehrung der Bacterien," *Beitrag zur Biologie der Pflanzen*, III, 1893.

ness of the tissues, it is a question, in the therapeutical employment of the current of its interpolar action. Even in cases where we place the electrodes directly on the injured surface, we do not cause a specifically polar effect of the current—in the sense as understood in physics. Between the metal serving as pole and the injured surface there must always be an intermediate layer of liquid—moistened chamois, wadding, linen or similar material—without which galvanization, with the exception of a few special cases, is impossible.

3. In cases, however, where the seat of sickness is concentrated in internal organs, such as the lungs, liver, etc., there can be no question of the therapeutical application of the polar action of the current.

In view of these observations, I made my experiments in the following manner: In order to have a homogeneous center, with uniformly distributed microbes, I sowed all cultures (with the exception of *M. Prodigiosus*) into beef bouillon. I kept the liquid containing the culture in a glass tube of a diameter of 1 cm. and a length of 20 cm. The two ends of the tube extended into vertical arms, *a*, *a'*, each 8 cm long. From the middle of the tube there arose a similar tube *b*. I placed in *a*, *a'* the electrodes of thick platinum needles, which were connected with a battery of 40 elements. A milliammeter was included in the circuit. Every time, before the galvanization, a culture was transferred from the liquid to the central tube, and in the case of experimentation with animals, there was also made an inoculation. Those primary cultures and inoculated animals served as proofs. Then the circuit was closed, and at determined intervals—without breaking the current—

experimental cultures and inoculations were made from the same central tube. After but a few experiments with *M. Prodigiosus* I became convinced that currents of 20 to 30 milliamperes during a period of 10, 15, 30, even 45 minutes, produce no sensible change in the vitality of the microbes open to our observation. Therefore I either had to increase the currents or lengthen their duration. But stronger currents heat the liquid and introduce a foreign agent—heat—which disturbs the clearness of the experiment. I, therefore, preferred to increase the duration of galvanization.

#### RESULTS OF THE EXPERIMENTS—MICROCOCCUS PRODIGIOSUS.

The cultures of this microbe only were made in gelatine. I judged as to the changes which the current produced in the vitality of this microbe, by the quantity of thinned-out gelatine and the quantity of colored substance (pigment) produced by the microbe. Repeated experiments proved that cultures, which were made from microbes, subjected one and one-half hours to the current, showed themselves less developed after 24 hours, in comparison with the proofs, with respect both to the quantity of thinned gelatine and the degree of coloring. This difference was employed in the cultures, which developed from microbes galvanized for one and three-fourths hours. After a two-hourly galvanization the growth of the microbes could be barely noticed. I did not observe the complete cessation of growth a single time within the limits of these experiments.

#### CHICKEN CHOLERA.

The experiments with these microbes had the purpose of learning the influence which galvanization exercises on its virulence and growing capacity. For this pur-



pose I inoculated intramuscularly at every experiment three rabbits with 1-10 cc.—the first with a normal culture (proof), and the second and third (experiment subjects) with cultures which had been subjected to galvanization for different periods. Simultaneously cultures were also made on bouillon. The experiment proved that a noticeable decrease in virulence occurs only, from the culture injected, after galvanization for one and one-half hours. The death of rabbits inoculated in this manner occurred 5, 10, and even 20 hours later than that of the proof. A galvanization of one and three-fourths hours or longer completely destroyed the virulence of the microbes. As regards the cultures, their growth did not cease even after a galvanization of 2 hours and 10 minutes. It interested me to test the degree of immunity of the rabbits which had remained alive after such an inoculation with this microbe. For this purpose I inoculated a rabbit which had been vaccinated 10 days before, and at the same time treated a proof with 1-10 cc. of a culture which had been subjected to galvanization for only 30 minutes. Both died, however, after 14 or 15 hours. A similar negative result was produced by an experiment with a rabbit which had been inoculated 13 days before, into which I injected—at the same time with a proof—1-10 cc. of a culture which had been subjected to a galvanization of 45 minutes.<sup>6</sup>

As to the question whether galvanized microbes give cultures of a lesser virulence, I obtained positive results by experiments carried out as follows: I prepared a culture of microbes which was galvanized for 1 hour and 40 minutes, and which killed a rabbit only after 39

hours. The culture thus produced was again subjected to galvanization, and I inoculated one rabbit with 1-10 cc. after 1 hour and 30 minutes, the second after 1 hour and 40 minutes and the third after 2 hours and 10 minutes. Cultures were also made simultaneously. The result was that all the rabbits remained alive and none of the cultures developed. It is clear that the generations, which generated from microbes galvanized within these limits, are considerably weaker in their virulence and proved incapable of further generation.

#### STREPTOCOCCUS.

The streptococcus, which I employed for my experiments, possessed very great virulence. Dr. Beszedko, who put this microbe at my disposal in the most amiable manner, increased its virulence in such a degree, that one-twentieth million in doses of 1-10 cc. acted fatally on white mice.

The experiments with this, as with the previous microbes, were for the purpose of studying the action exercised by the current, with respect to virulence and propagation. The inoculations were made subcutaneously on white mice at the root of the tail with 1-10 cc.

In the first experiment, which may serve as prototype for all the others, there were inoculated:

I. Proof with normal culture; died after 16 hours.

II. After galvanization of 45 minutes; died after 40 hours.

III. After galvanization of 1 hour and 10 minutes; died after 40 hours.

IV. After galvanization of 1 hour and 45 minutes; remained alive.

V. After galvanization of 2 hours and 10 minutes; remained alive.

The current strength was 25 to 30 milliamperes. All cultures made at the

6. As the question of immunity did not come within the scope of this work, and requires a special minute examination, I dropped it entirely in the subsequent experiments.

same time with the inoculations showed a prolific growth.

All other experiments made in this manner gave comparatively similar results. On the whole, it can be said that a noticeable decrease in virulence of this microbe can be detected only after a galvanization of 45 to 60 minutes. The decrease is in accordance with the length of galvanization. After about one and three-fourths hours the virulence disappears entirely with the dose and current strength indicated.

I did not observe a noticeable influence of the current on the growth of the cultures in these experiments. Does the virulence also decrease in the generations of *staphylococci* produced from galvanized microbes?

The experiments made for this purpose gave positive results.

The cultures which developed from microbes, galvanized for two hours and ten minutes, did not kill the animals after sixteen to eighteen hours, but after forty-five to forty-eight hours.<sup>7</sup>

As to the fact that I do not give definite, but approximate, figures in my observations, I can set forth the following reason in justification: In the combination of experiments, such as mine, so many different influences enter that it is quite impossible to repeat the same experiment with absolute accuracy. Only that which relates to the current can be repeated with exactness. As regards, however, the nourishment of the cultures, the animals employed in the experiments, and mainly the microbes themselves, these are factors which are only too changeable. It is an easy matter to carry out accurately one or two points, but to exactly group

all elements in order to accurately repeat an experiment, is a matter of impossibility. Nevertheless, definite conclusions can be drawn from a series of observations.

#### CONCLUSIONS.

My observations cause me to conclude:

(1) That the constant current exercises in the interpolar space a modifying influence on the vitality of the microbes.

(2) That currents of twenty-five to thirty milliamperes exercise in one and one-half to two hours an action varying from a weakening to an entirely deadly effect in their virulence.

(3) That generations, which develop from microbes galvanized in this manner, develop a lesser vitality than their generators.

How does the constant current act on the microbes in its interpolar space?

There are authors who believe that the study of the action of electricity on the animal body must consist in the explanation of the influence of a mysterious unit of a so-called pure electric agent, independently of other physical properties of this energy, such as heat, electrolysis, etc. Dr. Krüeger, for example, gives in his work, "On the Influence of the Constant Current on the Growth and Virulence of Bacteria,"<sup>8</sup> a whole series of special experiments, in order to fathom the influence of the "actual action of electricity." He says: "As with the entrance and exit of the current in liquids, the polarization and chemical decomposition of the same almost entirely cover the real action of electricity, it is absolutely necessary to exclude this disturbing secondary action \* \* \*." He does not explain what he means by "real action of electricity." The results of his experiments are recapitulated by him in the following

7. In order to extend the scope of my experiments, I undertook similar experiments with the *Staphylococcus*. Its virulence proved, however, so low that the wounds caused by it were too slight to merit mention here.

8. *Zeit f. Klin. Medicin.*, XXII, 1893.

manner: "It follows from these experiments that the constant electric current can, by excluding as much as possible the chemical action of the ions, if not kill, undoubtedly arrest, the bacteria completely in their growth." But he gives no explanation, excepting as to the ionic action, in what the influence of the current exists.

Apostoli and Laqueriere set forth their observations in their work, "*De l'action polaire du courant galvanique constant sur les microbes*," in the following manner:

(4) The general conclusion which follows from our researches is that the continuous current in medical doses (50 to 300) has no action *sui generis* in the microbe cultures \* \* \*.' The authors explain the results observed by them by the chemical action of the positive pole. This is quite rational, but it is incomprehensible as to what other action "*sui generis*" they expected of electricity. I make free to add that in personal conversation with many important scientists I have heard similar views expressed.

Such a view of the action of electricity on the animal body is, in my opinion, a complete error. Electricity, as a physical agent, influences matter irrespective of its nature, through the combined action of all its properties, and only in this way can the phenomena produced in the body be explained.

It is true that each time, in the different forms of this energy, its different properties appear as predominating. But there is no form of electricity in which any one of its properties is absent. Such an energy would not be an electrical one, but one which is still unknown to us. In the action of the constant current in properties and values, as employed by us in our experiments, its electrolytic proper-

ties are predominant. We must, therefore, look in them for the explanation of the results observed. There is no doubt that the constant current produces at the same time with chemical, also molecular changes in the animal body. But they continually go hand in hand, and can in no manner be studied separately. It is a matter of absolute impossibility to isolate the molecular from the chemical phenomena. This would also be entirely useless, as in the present condition of science these two phenomena are considered as identical in their nature.

In my work, "*The Basis of the Therapeutical Action of the Constant Current*,"<sup>10</sup> I came to the conviction by way of experiments that:

a. The electrolytic phenomena, which the passage of a constant current through the electrolyte causes, take place in the interpolar space as well as at the poles.

b. In the entire distance traversed the ions travel, as though charged with pressure electricity, to the poles as to the extreme points of highest attraction. This process will doubtlessly also take place, under the action of the current, in the liquid in which the microbes are suspended. The dividing of the electrolyte into ions and their migration will not only take place in the liquid alone, but also in the microbes in their protoplasm, which certainly contains electrolytes, as salts and water. This alone suffices to act in a modifying way on the vitality of the microbes. It has been determined in bacteriology that even a simple plasmolysis may prove deadly for microbes at a certain strength. The more reason to assume, that an electrolytical decomposition of the plasma must cause large changes in the physiological functions of the microbe. It is also known that the microbes,

9. *Comptes Rendus Ac. Sc.*, Vol. 110, 1890.

10. *Zeit. f. Elektrotherapie*, March number, 1900.



although they have a great death-resisting capacity, are quite easily affected by exterior influences, and easily react on the same. It is understood that in the center in which the microbes are suspended, the changes caused by the current—an increase in acid and alkalis—must also influence the vitality of the microbes. In this case the action of the current can be compared to that of sunlight, which, as has been determined, exercises through its chemical action on the center, a strong influence in retarding the growth of the microbes. As specially reductive of the bacteria were found to be the ions of oxygen and chlorine, appearing in a nascent state in the center and which, as known, are among the strongest bactericidal agents. In fact, there are sufficient reasons from consideration of the physical-chemical properties of the current to explain the changes in the vitality of the microbes which I observed in my experiments.

I will here take advantage of the opportunity to thank most warmly Dr. Borel, whose amiable and highly scientific advice greatly facilitated the execution of my work.

Involuntarily the question comes up, Does all this take place as accurately as in a glass? Certainly not with absolute accuracy, although according to the laws of physics, the constant current produces in the animal body, qualitatively as well as quantitatively, the same phenomena as in the experimental tube. The difference is probably caused by the conditions of the center. In the tube the current acts on a constant homogenous center, and on a perfectly limited mass. In the animal body, however, all these conditions do not exist. Here the current spreads much more fan-like. The products of electrolysis are partly produced and assimilated

by the surrounding tissues, and partly carried off by lymph and blood current. Therefore an acid resultant will not, all other things being equal, reach the same degree of intensity as in the tube. From this it follows that the current in the animal body will not exercise full influence on the microbe inhabitants, as is done in the experimental culture. But we must not draw the conclusion therefrom that the action of the current in the animal body is necessarily weaker. It may even be more intense. This will depend on the conditions under which the life of the microbe occurs in the animal body. In the experimental culture, the microbes are left to themselves, and under conditions most favorable to their nourishment and rapid propagation. In the animal body, however, they must battle for their existence with the elements of the surrounding tissues. They are placed under the necessity to overcome here for their nourishment and propagation, the complicated resistance of the tissue cells, which represents a considerable antagonism to their activity. It is clear from this that it is much more difficult for the microbes in the animal body to resist the action of the current, than in the experimental culture.

Nor may it be forgotten that the passage of the current<sup>11</sup> increases the local nourishment of the tissues, and with it the resistance of the cells. This circumstance will also in its turn make the conditions of living worse for the microbes. Finally, nothing forces us to limit the therapeutical galvanization to twenty-five to thirty milliamperes. We can, according to circumstances, increase the current two or threefold. Here the local increase in temperature, which I took such great

11. See my article: "Données biologiques relatives au traitement des inflammations aiguës par le courant continu." *Comptes Rendus du Second Congrès international d'Electrologie medicale*, a Bern, 1902.

care to prevent in my experiments, is not to be feared. Such a phenomenon would even be very useful in this case for therapeutical purposes. In his excellent and exhaustive work, "*Elements de microbiologie générale*,"<sup>12</sup> Dr. Nicolle says: "It has long been known that the leucocytes require a certain degree of temperature, in order to develop their ameboid activity \* \* \*. It is likewise known that the white cells greatly require oxygen and that they invariably turn to the points richest in air. Heat and oxygen thus represent here two powerful exciters." Under these conditions the current appears, so to speak, as exciter of phagocytosis, which under certain circumstances can render essential services to therapeutics.

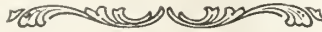
From all that has been said above, it can be concluded that the action of the current on the microbes living in the animal body is identical to the one which I observed in my experiments. In this manner the importance of the current as a therapeutical agent in inflammations becomes considerably greater. The current not only increases the resistance capacity of the tissue cells against the harmful agent, but also acts in inflammations of a

microbe origin directly on the microbes themselves, by reducing their vitality.

In the interest of scientific truth I found it rational in my examinations to limit every experiment to a single period of galvanization. With a patient we can, however, repeat the application daily, and in extreme cases, two to three times daily. And after such repeated action of the current, the therapeutical effect must become considerable. My experiments proved that the generations produced by galvanized microbes have a less virulence than their generators. We must assume that the microbe culture vegetating in the animal body will gradually generate weaker generations, following repeated galvanization. Their part as harmful agent must in this manner gradually lessen and finally disappear. At the same time the resistance of the cells attacked will increase up to their complete recovery.

All the above facts and observations offer new grounds to explain the favorable action of the constant current in inflammations. The clinical observations published by me and other authors may serve as direct confirmation of this. I intend, however, in order to fully clear up the question, to make further direct laboratory experiments and exhaustive clinical observations.

<sup>12</sup>. M. Nicolle: "*Elements de microbiologie générale*," p. 198.



#### A Roentgen Ray Congress.

A congress to discuss the Röntgen methods will meet in Berlin on April 30, 1905. Professor Röntgen will be the guest of honor of the congress, which marks the tenth anniversary of the publication of his discovery.

We regret to announce the death of Dr. I. P. Klingensmith, of Blairsville, Pa., who died at his home on September 27, 1904, after an illness of five months, aged 54 years and 5 months. He was a member of the American Electro Medical Society.

# Fifth International Electrical Congress, St. Louis, 1904.

## PERMANENT ORGANIZATION.

At the general meeting of the congress in the Coliseum Music Hall at 9:30 a. m. on Monday, 12th of September, the following permanent organization was adopted unanimously:

## GENERAL OFFICERS.

President—Prof. Elihu Thomson.  
Vice-Presidents—Mr. Bion J. Arnold (chairman of executive committee), Prof. H. S. Carhart, Prof. W. E. Goldsborough, Mr. C. F. Scott, Dr. S. W. Stratton.  
General Secretary—Dr. A. E. Kennelly, Harvard University, Cambridge, Mass.  
Treasurer—Mr. W. D. Weaver.

## OFFICERS OF SECTIONS.

|                                    | Honorary Chairman.    | Chairman.              | Vice-President.     | Secretary.           |
|------------------------------------|-----------------------|------------------------|---------------------|----------------------|
| A—General Theory.                  |                       |                        |                     |                      |
|                                    | Dr. S. Arrhenius.     | Prof. E. L. Nichols.   | Prof. W. L. Miller. | Prof. H. T. Barnes.  |
| B—General Applications.            |                       |                        |                     |                      |
|                                    | Prof. G. Grassi.      |                        | Mr. W. Deddell.     | Prof. S. Sheldon.    |
|                                    | Prof. C. Zipernowsky. | Prof. C. P. Steinmetz. | Prof. F. Weber.     |                      |
| C—Electro-Chemistry.               |                       |                        |                     |                      |
|                                    | Prof. Dr. W. Ostwald. | Prof. H. S. Carhart.   | M. Dennery.         | Mr. Carl Heung.      |
| D—Electric Power Transmission.     |                       |                        |                     |                      |
|                                    | M. Paul Janst.        |                        |                     |                      |
|                                    | Ing. A. Maffezini.    | Mr. Chas. F. Scott.    | Ing. E. Jona.       | Dr. Louis Bell.      |
| E—Electric Light and Distribution. |                       |                        |                     |                      |
|                                    | Miguel Otamendi.      | John W. Lieb Jr.       | Dr. George Newbery. |                      |
|                                    |                       |                        | Senor R. P. Arizpe. | Mr. Gano S. Dunn.    |
| F—Electric Transportation.         |                       |                        |                     |                      |
|                                    | Herr Baron Ferstel.   |                        |                     |                      |
|                                    | G. J. von Swaay.      | Dr. Louis Duncan.      | M. Marius Latom.    | Mr. A. H. Armstrong. |
| G—Electric Communication.          |                       |                        |                     |                      |
|                                    | John Hesketh, Esq.    |                        | M. Ferrie.          |                      |
|                                    | H. E. Harrison, Esq.  | Mr. F. W. Jones.       | J. C. Shields.      | Mr. B. Gherardi.     |
| H—Electro-Therapeutics.            |                       |                        |                     |                      |
|                                    | Prof. J. A. Bergonie. | Dr. Wm. J. Morton.     | M. G. de Nerville.  | Mr. Wm. J. Jenks.    |



### Notes of the Meetings.

The committee of organization of the International Electrical Congress, 1904, was appointed by the president of the St. Louis Exposition, June, 1903, and held its first meeting July, 1903. In response to invitations to join the congress over 2,000 acceptances have been received, 1,600 from the United States and 400 from other countries. On September 11th the rolls of the congress contained 1,700 names as having completed membership by payment of fee. In response to invitations to well-known workers throughout the world, 170 papers were presented to the congress, of which nearly 100 were in type for distribution at its sessions. The papers presented were generally of a high order of merit. They will be printed in a bound volume and distributed to members of the congress. The price of the volume to non-members is \$10.

#### SECTION II—ELECTRO-THERAPEUTICS.

Under the able direction of the chairman, Dr. William J. Morton, twenty-one papers were presented, some of which summed up existing knowledge on certain subjects, while others gave reports of original and valuable investigations. Prominent among the latter were Dr. Morton's paper on "Artificial Fluorescence" and Professor Schatzky's paper on "Effect of the Constant Current on Microbes."

In the absence of their authors a number of the papers were read by title only. The discussions were animated and brought out much valuable information. Altogether section H was one of the most successful of the sections of the congress.

#### FLUORESCENCE ARTIFICIALLY PRODUCED IN THE HUMAN ORGANISM BY THE X-RAY, RADIUM, OR THE HIGH- FREQUENCY CURRENT.

Dr. William J. Morton read this paper and illustrated it by a considerable number of photographs. By the use of fluorescent solutions, taken internally, new radiations are set up in the tissues by the x-ray, light, etc. The human body normally contains a fluorescent alkaloid, "chinoidin." In malaria he had found the chinoidin reduced in quantity or completely absent. Quinin in sufficient doses restores artificially the fluorescent character of the blood and in this way destroys the malarial germs. In some experiments he found that paramaecium in a fluorescent solution was able to live thirteen hours in the dark and only eight minutes in the light. It is found that the yellow and green light affect micro-organisms more strongly than the violet rays in fluorescent solutions. The substances experimented with are quinin, esculin and fluorescein, which he selected because of their harmless character. Twenty drops of a 3 or 4 per cent solution of one of these substances was administered, and an x-ray photograph of the hand was taken an hour later. The photograph was much more distinct in detail than one previously taken. The fluorescent effect is also made evident by holding a tube of radium against the ear in a dark room, when a distinct glow is visible.

Dr. Morton reported marked improvement in various patients by raying after the use of the fluorescent solutions. He was accustomed to give five drops after meals three times daily and to gradually increase the dose to twenty drops if tolerated.

## REPORT OF THE COMMITTEE ON NOMENCLATURE AND STATIC MACHINES.

This report was read by Prof. Samuel Sheldon at the joint meeting of Section H with the American Electro-Therapeutic Association. A series of experiments was undertaken by the committee to determine the efficiency of the machines. Only three machines had been furnished to the committee in time for this test. The results showed that the efficiency was very small when the machines were running slowly. When the current furnished was near the maximum the efficiencies were 41 per cent for the Waite & Bartlett, 46.2 per cent for the Van Houten & Ten Broek, 42.8 per cent for the McIntosh. Taking into consideration the various sources of loss thru friction of air, friction of the bearings and leakage of the current, this efficiency of over 40 per cent in each case was considered highly satisfactory. The current is proportional to the speed of the machine, to the length of the collectors, to the distance of the combs from the center and to the number of collecting points. Full details were given of further experiments to determine the output of the various machines tested. The 8-plate McIntosh, speed 400, gave 0.649 milliamperes. A 10-plate Waite & Bartlett, speed 380, gave 0.725 ma. A 2-plate Wagner (mica plate), speed 1,305, gave 0.34 ma. A 12-plate Van Houten & Ten Broek, speed 340, gave 0.968 ma. An 11-plate Titus, speed 265, gave 1.042 ma. Professor Sheldon regretted that more machines had not been placed at the disposal of the committee. The output in milliamperes is the

equivalent steady discharge. The actual discharge from a static machine may be as high as 1,000 amperes, but each discharge continues for only a small fraction of a second.

Professor Jenks, the secretary of the section and a member of this committee, made brief reference to the two earlier reports of this committee to the electro-therapeutic association. He said the speed of a Wagner disk, at the center of the comb, was 4,400 feet per minute, or fifty miles an hour, while the speed of the McIntosh disk was only 1,200 feet per minute. Professor Jenks thought there was a good deal of misapprehension regarding high-frequency currents, many practitioners thinking they were using high-frequency currents when they had only the ordinary impulsive or spark discharge. The current is oscillatory when the square of the resistance multiplied by the capacity of the circuit is less than four times the inductance. Thumb rules may be adopted in order to secure high-frequency discharges; first, make the relative capacity of the body of the patient small, so that it becomes a conductor only and not a condenser; second, make the resistance of the whole circuit as low as possible; and, third, increase the inductance by the use of a short and coreless helix of heavy wire.

The resistance of a 2-inch air gap, which is probably 100,000 ohms or more, may become not more than 100 ohms after the spark has once begun. With the ordinary size Lyden jars, assuming the resistance of the patient to be 400 ohms, the frequency of the oscillation is nearly 6,000,000 per second.



## Electro-Therapy.

LESSON XV.—X-RAYS.—CONTINUED.

BY T. PROCTOR HALL.

X-rays are believed to be pulsatory electric waves of the same nature as waves of light, produced by the impulses of charged particles in the kathode stream. Nothing definite is known as to the nature of the differences among rays of high and low penetration, but since rays of high penetration are produced from a kathode stream of high velocity it seems probable that these waves are shorter and of greater relative amplitude than those of low penetration.

In considering the production of x-rays from a Crookes tube the source of the current is of no importance provided the electromotive force and amperage be sufficient. A 16-plate static machine gives scarcely enough current for heavy x-ray work. The static current is also less under the control of the operator than is the current from a well-constructed coil. In other respects the static machine is just as good as a coil, and vice versa. The quantity of current supplied to the x-ray tube, its electromotive force and its impulsiveness are the three features of prime importance. The rapidity of the impulses is a factor of the volume of the x-rays produced. The value of the electrolytic interrupter in the primary circuit of a coil consists in the suddenness and rapidity of the interruptions. Other things being equal, 2,000 interruptions per minute give twice the intensity of x-rays obtained from 1,000 interruptions per minute, tho the penetration of the rays may be the same in the two cases.

In a plain Crookes tube the antikathode is a disk at the center of the bulb. Opposite this is a disk-shaped aluminum

kathode. When an impulsive current passes thru the tube, particles of the gas are thrown from the kathode violently against the antikathode, from which they rebound and strike the wall of the tube. The impulsiveness of the impacts depends in part upon the vacuum of the tube, in part upon the style of interruption in the primary current of the coil and in part upon the other resistances in the secondary circuit. Particles of the gas appear to become entangled in the wall of the tube, and after some time the vacuum of the tube becomes higher. Various devices are employed for reducing the vacuum. The only plan available for the plain tube is heating, which must be done gradually and maintained for from fifteen minutes to an hour, and followed by very gradual cooling. The temperature required is 400° or 500° F. After baking, the tube appears to be the same as it was before using, but after repeated use, particularly with a heavy current, a tube is found to have undergone changes which impair its efficiency. These changes are not well understood. They mark the ageing of the tube. The rays produced from an old tube appear to be less homogeneous. Tubes age very rapidly when used with a heavy current and very slowly when used with a light current. Some differences appear to depend upon the kind of gas contained in the tube, but the whole matter of aging needs further investigation.

The regulation of the vacuum is also accomplished by a number of special devices which are more or less efficient, but not perfectly satisfactory. If an operator has only a few tubes it is advisable to



have them of the self-regulating type. Operators who use a large number often prefer the simple tube, from which they are able at any time to select one having the right vacuum for the purpose required.

When the vacuum is low the kathode particles are projected at right angles from its surface. When the vacuum becomes high the particles repel each other more forcibly and come to a focus at a greater distance from the kathode. With a given kathode, therefore, the focal distance of the stream changes with the vacuum of the tube. In x-ray photography, in which it is important that the antikathode should be at the focus of the stream, each tube does good work when the vacuum is within a certain limited range, and gives shadows more or less blurred when the vacuum is either above or below these limits. A tube with adjustable anode has been designed to meet this difficulty. For therapeutic work it is not necessary that the antikathode be at the focus of the stream, nor is it necessary to stop the stray x-rays which are produced from various parts of the

tube by stray and reflected kathode rays. For photography these stray x-rays should be eliminated by two lead screens, one having a small hole and placed near the tube, the other having a larger hole and placed close to the object, so as to allow only the required cone of rays to pass thru both holes.

The x-rays are scattered to some extent by almost all substances, but the amount of the scattering in different cases is very different. The rays that strike upon a lead plate are nearly all transformed or destroyed; those that strike upon a silver plate are very largely reflected or diffused; a silver plate may, therefore, be used as an intensifying screen in x-ray photography. If the silver plate is close behind the gelatin film, the effect of the rays upon the film is nearly doubled. The action of the silver appears to be a surface action only. Other substances, such as wood and air, cause a diffusion of the ray thruout every part. For this reason it is advisable in taking a photograph to have as little air as possible between the object to be photographed and the sensitive plate.

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## X-Ray Diseases of the Skin.\*

BY C. H. FESSENDEN, M. D.

I have selected as the subject of this paper the treatment of a class of cases which, while to the x-ray therapist it presents no particular novelty, has been carried out with the routine employment of a tube of high vacuum in all cases, for which, in the beginning of my work at least, there was no precedent, the weight of authority being in favor of the low-

vacuum tube and the production of a "mild dermatitis."

My first essay into the field of therapeutic work was in the treatment of a case of recurrent carcinoma of the breast, in which I happened upon one of the few patients whom I have found to be unduly sensitive to the x-ray. In this case the second treatment given with a low tube was followed by such a violent reaction as manifested by elevated tempera-

\*Abstracted from a paper read before the National Society of Electro-Therapeutists.

ture and a general erythema of the trunk, not only of the portion rayed, but of the back and sides as well, that I acquired perhaps an undue respect for the mighty force which I had liberated. These circumstances, together with the desire of avoiding the much-dreaded burn, were the determining factors which led to the routine use of the high tube; but as the work progressed it was noticeable that the results were as rapidly obtained as in reported cases of a similar nature wherein use had been made of the low tube and the production of an artificial dermatitis. Latterly the use of the high tube has been adopted as a matter of deliberate choice, and results have been sufficiently prompt and gratifying to warrant a continuation of a method whereby it is possible to assure the patient that there is little or no danger of producing the x-ray burn, a bugbear that is present in the minds of a surprisingly large proportion of persons presenting themselves for treatment, due, no doubt, to an injudicious and sensational secular press. Indeed, the majority of general practitioners are not free from the association of the use of the x-ray with a degree of danger to the patient far in excess of that which presents itself to the mind of one who is familiar with this class of work.

The first application of the ray to abnormal skin conditions was in the case of an eczema occurring in one of my nurses. There were present on the elbows and the extensor aspect of either forearm a number of dry, scaly patches, varying in size from that of a 10-cent piece to that of a silver dollar. These had been present for a number of years, dating back to her school days, at which time they made their first appearance, resulting, apparently, from friction and pressure from the school desk. During a pe-

riod of two weeks three applications were made to each arm of fifteen minutes' duration, and with the anode one foot from the skin. The result was the entire disappearance of the roughened condition, the only evidence of former disturbance being the persistence for some weeks more of a dusky discoloration upon the sites of former lesions, and even this in time entirely disappeared, leaving an apparently normal integument. This relief continued for some two years or more, but the condition has since recurred following marriage and parturition.

Later on my small apparatus was replaced by a 10-plate machine and a more extended equipment of tubes of the adjustable variety; and with this more powerful apparatus the cases following have been treated during the past year; and, while the number is not large, it represents all cases treated during that time which have not heretofore been reported and which can come strictly under the classification of skin diseases. This is simply mentioned in passing that it may not be presumed that a selection of favorable cases has been made, the desire of this paper being to present an absolutely accurate summary of work done, that the true value of this method of treatment may be shown.

Case 2.—This patient was a domestic who had been suffering for a number of years from eczema of the palms and palmar surface of the fingers. Treatments were given for fifteen minutes at one foot three times a week. The first few treatments relieved the painful condition, and at the end of the second week there was an entire healing of the fissures. Later they recurred in a slight degree, to yield still more readily to treatment, and finally, at the end of three months, eighteen treatments having been given in all, the

case was discharged as apparently cured, and I believe the result to have been permanent, as she gave assurance that, should there be a recurrence, she would again report for treatment, and at the end of some nine months she has not yet so reported.

Case 3.—This case was one of psoriasis occurring in a young married woman, and which had been present for three or four weeks. There were isolated patches upon the upper portion of the chest, also upon the back and posterior aspect of the thighs. Each locality was rayed at one foot for ten minutes. The first application relieved the itching in a measure, and after three treatments, covering a period of eight days, entire relief was obtained and the case discharged.

Case 4.—This was also a case of psoriasis, the patient being a young man of 30 or thereabouts and of a decidedly neurotic temperament. The eruption was confined to the back and to the inner aspect of the thighs. At each sitting two exposures of fifteen minutes each were made upon the back and thighs respectively. Five treatments in all entirely removed the disturbing conditions. During the progress of the treatments there was developed one of the chance by-effects which have given a valuable hint in static treatment of neurotic patients. After the first treatment the patient reported that, following the raying of the spinal column, there occurred a particularly buoyant condition and a sense of exhilaration with an increased power of endurance. This result was not entirely temporary, as at the end of treatment there was a sense of general well being, such as had not been experienced for some time. Following up this hint I have, in a number of neurotic cases, employed a five-minute raying of the spine at a dis-

tance of eighteen inches with most gratifying results. Granted that this effect may be psychic in a measure, it has seemed to be none the less a beneficial one.

Case 5.—This patient, a blacksmith by trade, was also referred to me for an obstinate attack of psoriasis occurring upon the back. The heavy underclothing and the perspiration incident to his occupation produced an additional irritation and the itching was nearly unbearable. In this case the eruption was confined entirely to the back, which was generally covered with isolated patches. Exposures were made for fifteen minutes at one foot with a high tube. There were given in all six treatments, covering a period of two weeks and a half, at the end of which time the irritation had disappeared and the skin regained normal conditions.

Case 6.—This case was perhaps the most satisfactory of any that have come under my care, inasmuch as it was one which had been pronounced incurable, both by general and special practitioners; indeed, I myself, so he reminded me, told him some twelve years ago that I should have to give him up as a bad job. The patient was a man of middle age, with the following history: He has always been a man of good and regular habits, and up to the time of early manhood had been perfectly free from all abnormal skin conditions. At that time, during a smallpox epidemic, vaccination was followed by a succession of boils in various parts of the body, which in turn were followed by an appearance of eczema, first under the arms and latterly appearing successively upon various parts of the body, leaving one locality as it appeared in a new spot. All sorts of measures, local and consti-



tutional, had been tried during the last thirty years without relief.

The surface of each leg was exposed at a distance of one foot for fifteen minutes. After a few treatments the skin gradually became somewhat more pliable and the irritation less marked. After the first half dozen treatments each sitting was supplemented with an application of the brush discharge from a wooden electrode with a metallic tip. From this time improvement seemed to be more rapid, and at the end of the eighteenth treatment the case was discharged with perfect freedom from all irritation, the skin having assumed its normal thickness and pliability. The only measure, other than electrical, adopted in the treatment of this case was the nightly inunction with plain lanolin. The last treatment was given early in February, and at the present writing there has been no return of abnormal conditions. The notable feature in the treatment of this patient was the more rapid progress after the adoption of the supplementary brush discharge.

Case 7.—This young man, a painter by trade, had been suffering for nearly a year from an obstinate and painful dermatitis of the palms and palmar surfaces of the fingers, following a specific infection. The entire palmer surfaces of both hands were covered with a desquamating epidermis, closely resembling that following scarlatina, and which left behind it a tender red skin, which in turn thickened, cracked and desquamated. There were also numerous deep and painful fissures, bleeding at times. The whole condition was considerably aggravated by the nature of his occupation. Treatment was given three times a week with a tube at one foot from the skin, and relief was soon manifested in the healing of the fissures and cessation of soreness, but

desquamation again took place, although leaving this time a more nearly normal surface. Continued treatment finally restored normal conditions after about three months.

One noticeable feature of this case was the entire absence of perspiration, and to overcome this condition during the latter half of the time the following expedient was adopted: An electrode conforming to the shape of the palms was made of two layers of thick tinfoil with a layer of absorbent cotton between the two layers of foil to insure perfect coadaptation to the irregularities of surface. By means of this electrode a ten-minute application of the Morton wave current was made at each sitting, resulting in the production of a profuse perspiration, and from the time of the adoption of this measure progress toward recovery became much more rapid.

Case 8.—This case has proved to be one of the most stubborn as well as one of the most satisfactory in its ultimate result. The patient, a young lady teacher, has had from a period dating from girlhood a particularly aggravated dermatitis of the palms, associated with a general anemic condition. She was first referred to me early in the present year, having already had eight x-ray treatments at her home during the Christmas vacation, so that improvement had already begun, and I did not have an opportunity to see the case at its worst. At this time the larger portion of the palmar surface of each hand was covered with a thick, dry, scaly epidermis, with numerous fissures, particularly about the roots of the fingers and in the folds between the thumb and index finger. The condition, aside from being a painful one, was the source of constant annoyance because of the unsightly condition of the hands. Two to

three treatments a week were given with the high tube at one foot from the surface for fifteen minutes. Between January 8th and March 29th eighteen treatments in all were given, and at that time the left hand was entirely well and the right so nearly so that it was hoped that the accumulative effect of the treatments might carry along until normal conditions were established. However this did not occur, and early in May treatment was resumed, the lesion being confined to a slight roughness in the fold between the thumb and index finger of the right hand with one superficial crack. Treatment twice a week was given through May and the case was discharged June 3d with an apparently normal integument upon both hands, a condition that has not existed since the first onset of the disturbance. As an auxiliary measure during the first period of treatment thin rubber gloves were worn at night and a local application to which she had resorted previous to treatment, consisting of a proprietary preparation, the principal ingredients of which appeared to be tar and glycerine, was employed. Constitutional treatment, the nature of which I am unfamiliar with, was kept up by her regular physician. During the latter period of treatment use of the high-frequency current through a vacuum electrode was made supplemental to the regular raying with apparent advantage. Prognosis is at the present time doubtful, but in any event there is a

present freedom from all annoyance, either from a physical or esthetic point of view, and, to the mind of the patient at least, the result has amply warranted the trouble and expense incurred in reaching it. Certainly all methods employed for relief had been futile until this one was employed.

A careful consideration of the method employed in the treatment of these cases would seem to bear out the idea suggested at the last meeting of this body, viz., the twofold action of the ray depending upon the vacuum of the tube employed and its analogy to, if not identity with, the twofold action of the crude and attenuated drug.

In a large number of varying conditions I have depended upon the tonic action of the ray from the high tube, in all cases avoiding production of irritating effect, either from the low tube or the too frequent or too prolonged exposure to the high tube, believing this to be the logical and safe method of treatment. It is generally admitted that abnormal skin conditions, as well as morbid growths, depend upon a tissue condition of low vitality, yielding to a degree of radiance short of that sufficient for the destruction of normal tissue. Furthermore, there seems to be a primary tonic action of the ray far short of its destructive action which increases functional power in the skin and glandular organs.



## Unipolar X-Ray.

BY SAMUEL STERN, M. D., NEW YORK.

Amongst the defects of the Crookes vacuum tubes of today—as they are used for the production of x-rays for therapeutic purposes—perhaps the most glaring is that they must necessarily be connected with both poles of the apparatus. This makes practically a stationary apparatus, does not permit handling with any degree of ease, and often prevents us from using the effective rays on surfaces not easily reached, or those situated in the various cavities of the body.

A number of attempts have been made to construct tubes with long cylindrical projections, which may be used in cavities. These projections are from six to eight inches long, which brings the distance from the anode, where the rays are generated, to the tip of the projection, where they are emitted, up to ten inches or more. As the projection can rarely be passed up directly to the lesion treated, we must allow for several additional inches of distance, reckoned from the source of the ray. Considering that the intensity of exposure is in inverse square ratio to the distance from the source of the ray, we find that, allowing for a distance of about twelve inches, these exposures would have to be greatly prolonged to be effective.

This is a very serious drawback in treating lesions situated in cavities (such as the throat, for instance), where the time of exposure, on account of the inconvenience of keeping the tube in position, is of vital importance. The rays as they are emitted from the cylinder travel in all directions, and it is a very difficult matter to protect the healthy surrounding tissue from their injurious effects.

In experimenting with various forms

of high-frequency resonators, I have found that if two Leyden jars are connected by their internal armatures to the two poles of a coil, and the external armatures are connected to a spiral coil having a few strands of thick wire, followed by spirals of fine wire, the current which is derived from the inner extremity of the spiral, when connected with one pole of a Crookes vacuum tube will produce x-rays. This arrangement is very similar to the apparatus known as the Oudin's resonator.

This method enables us to use vacuum tubes of different sizes and shapes, small enough to be passed into the throat, or any other cavity, with the position of the cathode and anode arranged in a way that the rays can be made to travel in any direction desired. For instance, in the treatment of the larynx, the tube can be passed into the throat over the larynx, the rays being directed downward, so that they will strike the larynx directly without being compelled to travel through any intervening tissue. In treating the oesophagus, these bulbs can be made so as to be attached to a flexible rubber tubing, which may be passed down to the lesion to be treated. While limited time and opportunity have not permitted me to make experiments in regard to passing these bulbs into the stomach itself, I see no reason why an arrangement similar to that devised by Exner\* and Einhorn,† for the introduction of radium into the stomach, should not be used as effectively in introducing these bulbs. The fact that they are attached by only one pole, and that the

\**Wiener klinische Wochenschrift*, January 28, 1904.

†*Medical Record*, March 5, 1904.



bulbs can be made of any desirable size, should make it a simple matter. Similar methods can also be used for the introduction of these bulbs into the rectum or vagina. The tubes which I have used are simply small vacuum bulbs with a cathode fused into one extremity, and an anode into the other, placed at the usual angle. The cathode extremity of the tube is attached to an insulated glass handle similar to those used in treating by high-frequency currents. This is screwed into a wooden handle, with a wire running thru it, inserted to the extremity of the cathode. The whole arrangement appearing as an ordinary elongated high-frequency tube, with the exception of the infused cathode and anode at its extremity. The anode has no attachment on the outside of the tube, and is merely used

to direct the rays toward the point desired. Experiments tend to show that the anode is superfluous, and that the rays can be generated directly on the glass. These bulbs, on account of their minute size, become hot in a short time, but considering that the source of the rays can be brought so closely to the lesions to be treated it is seen that a half-minute exposure at a distance of perhaps one inch from the source of the ray is equal to a number of minutes with the tube at the usual distance. There is some sparking from the surface of the tube, due to the high-frequency currents passing through it, which can be remedied by enclosing the entire tube in rubber, with the exception of the parts through which the rays are desired.—*Med. Record.*

#### A New Remedy for Appendicitis.

German medical journals are recommending a new and peculiar remedy for appendicitis, the employment of which, it is declared, will obviate the necessity for the use of the knife in the great majority of cases. This remedy consists in walking on all fours twenty minutes four times a day. A contemporary states that this method is not only original, but almost aboriginal. However this may be, the method is certainly worthy of consideration. This method of treatment operates by strengthening the abdominal muscles. When the muscles have relaxed, the bowels become displaced, congested and diseased; the disease extends to the appendix, and thus an inflammation is produced. It is claimed that a well-known German diplomat has been recently cured of chronic appendicitis by this method.

We do not doubt that a person having this disease, if not in an acute stage, may

benefit by getting down on all fours and walking like a dog; but there is something more he must do, also. Though he may with benefit walk like a dog, he must stop gnawing bones like a dog. The dog's method of locomotion is good gymnastics for strengthening the abdominal muscles, but the dog's diet is not adapted to the human constitution. Flesh eating has repeatedly been shown to be an active cause of appendicitis. Persons who do not eat flesh are little subject to appendicitis. This has been clearly proved by statistics collected in Algeria and elsewhere where there is an opportunity for comparison of flesh-eating and non-flesh-eating classes. Undigested fragments of flesh undergoing decomposition in the colon are especially the cause, setting up inflammatory processes in the colon which easily extend to the appendix and even to parts that are more remote.—*Health.*

### Animistic Medicine.

The rapid increase of schools, teachers and practitioners of psychic healing indicates more than a mere craze. There is conviction in it. We are not dealing with simply besotted visionaries. They are as rational as we are, and they are as able to bring out conclusive argument as any of us, supported by Holy Writ, logical reasoning and actual good results. They believe in their methods, whereas very many who denounce them are physicians that have little confidence in their own modes of medication. Oliver Wendell Holmes, when he made the wholesale declaration that the entire assortment of drugs was injurious to mankind, voiced the sentiment of the great body of medical men. He would never be the man to deny what the greatest among them have repeatedly asserted, that the current methods employed by them had annihilated no disease, but, on the other hand, had increased the number and often rendered them more deadly.

The modern animistic schools certainly offer us better results than this. They do not profess to go counter to law, but to apply it rationally and normally, consistent with facts and principles which we know and accept. We who have studied medicine and the description of diseases are aware that disorders are often caused by mental emotion: that fear alone will occasion insanity, paralysis, uncontrollable perspiration, cholera, jaundice, sudden decay of teeth, anemia, skin disease, erysipelas and eczema. Every passion has its peculiar bodily expression. Even false religion makes an unwholesome body. Mind translates itself into corporeal tissue. Why need we demur, then, if we are told that the converse of all this is equally true? It certainly does not seem illogical. If this universe is

ruled and held in existence by force and law, then that force and law must be intelligent, and, of course, alive. In such case it may be in the power of individuals to come into harmony and closer communication with the life which creates and sustains the universe. If we can bring rain and lightning from the sky, it is not unreasonable to believe that we can attract, absorb and assimilate vital energy from the great source of life. It may be by faith, which is the willful reaching forth of the mind and consciousness toward that which is higher; or it may be a sober, intelligent self-discipline which brings the individual at one with the forces of nature. Medicines, modes of exercise, regimen and even amulets and ceremonies may be found salutary in the way of effecting such an end.

It may be, as Henry Wood describes, that while all these magnificent results are possible, the great impediment to their attainment generally is because "the average man is inclined to vacate the control of his being, put his body into the keeping of his doctrine and his soul [himself] into the care of his priest or pastor."

Under such circumstances we of the common order must deal with our subjects on the plane where we find them. Till men can subsist on angels' food they must eat bread and the fruits of the earth. So, when they can not communicate, whether by faith or health-giving thought, with higher fountains of health, they will seek for healing medicines for their maladies, and in the fury of intolerable pain will hurry to the dentist for deliverance from an aching tooth. Many of us are too weak of mind for these higher things. Yet to those who would persecute mind-curers and others I would repeat the words imputed to Gamaliel: "If this

counsel or this work be of men it will come to naught; but if it be of God, ye can not overthrow it; refrain, therefore, from these men and let them alone, lest haply ye be found to fight against God."—*Dr. Alexander Wilder, in National Transactions.*

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#### N-Rays.

A discussion before the recent Brit. Ass'n meeting was opened by Lummer, Becquerel having left the room before. Lummer started with the very candid statement that the subject would not have been worth notice but that the French Academy had recently awarded a prize to Blondlot for his work on n-rays. He was aware, of course, of the photographic evidence which had been produced for the existence of n-rays, but that the exact procedure in these experiments had yet to be carefully scrutinized. He quoted Becquerel's opinion that n-rays have their effect by being reflected into the eye and augmenting the sensitiveness of the retina. As for himself, he was inclined to the opinion that the result was largely physiological, perhaps even in some degree psychological. He described, to illustrate his physiological possibility, an experiment which can be performed with a candle in one's bedroom—though, as he said, the observer's time would be much better occupied in sleep. The experiment consists in approaching a candle toward the eye in a line parallel to and to one side of the visual axis. At a certain distance, the pupil begins to undergo contractions, giving the impression of variable luminosity." Of the members present 15 had made experiments to detect n-rays, but only one claimed to have succeeded. The latter described cases in which an observer watching a phosphorescing screen had detected the approach to the back of the

screen of pieces of various substances. Rubens remarked that he had once persuaded himself he could trace dimly the motion of his hand behind such a screen, but had found he could not do likewise with other people's hands. He thought that "suggestion" had a great deal to do with the alleged phenomena. Butler gave evidence of the effects of "suggestion" and pointed out in this connection that since Blondlot's measurement of the velocity of Roentgen rays is interlinked to some extent with his n-ray researches, that measurement ought to be carefully repeated. "Thus, it will be seen, the feeling of the meeting was one of cautious, not to say uncharitable, scepticism."—*Lond. Elec., Aug. 26.*

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**The Structure of the Atom.**—J. J. Thomson (*Phil. Mag.*, March) discusses a mathematical problem suggested by the view that the atoms of the elements consist of a number of negatively electrified corpuscles enclosed in a sphere of uniform positive electrification. The problem discussed by him is the motion of a ring of a given number of negatively electrified particles placed inside a uniformly electrified sphere. The general equations are first developed and are then applied to the cases of two, three, four, five and six corpuscles and the mathematical conditions for the stability of a ring containing more than six corpuscles are developed. The author then applies his mathematical results to the hypothesis that an atom consists of a number of corpuscles moving about in the sphere of uniform electrification, and shows that if the corpuscles are constrained to move in one plane they will arrange themselves in a series of concentric rings, while when they can move about in all directions they will arrange themselves in a series of concentric shells. The



author adds the extremely interesting proof that if we assume such a structure of the atom it will have properties analogous in many respects to those possessed by the atoms of the chemical elements, and that in particular the properties of the atom will depend upon its atomic weight in a way very analogous to that expressed by the periodic law.—*El. World and Eng.*

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**Pneumatic Cure for Blindness**—There has recently been noticed a pneumatic cure for baldness. This is based on the old, old theory that the loss of the hair is caused by a diminished blood supply with resulting atrophy of the hair bulbs. Positively the last thing in the treatment of this affection is what is known as a "capillary chalice." We trust that our denominational friends will not be shocked at this use of the word, but will take the broader view that is derived from the Latin *valix*, meaning a cup, and that it is only within the last half-dozen centuries that the word has been specifically used to designate the communion cup. Besides, to what more noble purpose could an instrument with any name be applied than in the relief of baldness, the deformity of youth, and scarcely to be borne with equanimity in old age. The mechanism of this treatment is simply the old one of cupping.

The chalice is nothing but a hollow rubber pad from which the air can be exhausted, and in this way the circulation of the scalp stimulated so as to produce healthy hair follicles and stimulate the normal growth of the hair. We are left in no doubt as to the efficacy of the treatment, for the advertisement of the company selling the instrument contains a number of illustrations of "before" and "after" treatment. A number of men are shown with remarkably smooth pates, and

later we see the same heads covered with hair that would be the envy of any barber in the land. We are informed that the "chalice" does not aim to produce a perfect vacuum, which, of course, nature abhors, but that it is only a partial one. We are gratified at this conservatism on the part of makers of the cup, because a perfect vacuum might result in the loss of a portion of the scalp, and there would be little hope of restoration, as even with this method of stimulating the circulation it could hardly be hoped that the denuded cranium could produce a luxuriant crop of hair.—*Health.*

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#### Medical Electricity.

Electricity used in various forms has come to be a valuable adjunct in medicine and surgery, and undoubtedly will in the course of time be a much more important factor in the treatment of diseases and injuries than it is even now. Medical electricity is as yet but in its infancy. Of the many modes of harnessing electricity to the use of the medical man the production of x-rays is the most conspicuous, and is fast taking its rightful position as an almost indispensable means of diagnosis in certain cases.

The *Hospital* of May 23, 1904, contains a resumé of the latest literature concerning medical electricity. Brock and Stanley Green have pointed out, in the *Quarterly Medical Journal*, that the x-ray tube is of service in the more complete definition of diseased lung in phthisis. They have now had a number of cases to base their deductions upon, and declare that: (1) In no single case in which the physical signs have pointed to disease have the rays failed to detect the mischief; (2) in some cases in which physical signs have

been absent the rays have shown deposits in the lungs, and in these cases physical signs have subsequently been detected; (3) the early diagnosis is certainly helped; (4) that the extent of the disease is in many cases shown to be greater than the physician thinks; (5) that the progress and results of treatment can be watched with greater accuracy.

Chisholm Williams, in the *British Medical Journal*, gives favorable testimony as to the beneficial effects of high-frequency currents in the treatment of phthisis. In 1901 he recorded forty-three cases under treatment, and now of these, three have died of pneumonia, of tuberculous kidney, and of lardaceous disease. He advises that the apparatus be of the most powerful available. In tuberculosis of other parts, joints, etc., the best results have been obtained by general electrification combined with a high vacuum electrode used from the resonator, or the ordinary x-ray discharge. Cases of old-standing tuberculous lesions he states to be very amenable to treatment. In the treatment of lupus he finds the x-ray tube as reliable and to produce as good results as the light treatment. He urges the use of the high vacuum electrodes with a vacuum high enough to produce fluorescence on an x-ray screen. Also the patient should receive on the condensation couch as much as 350 milliamperes and upward. In opening the discussion upon the subject of electro-therapies in the treatment of malignant diseases, at the annual meeting of the British Society of Electrotherapeutists, Lewis Jones raised numerous questions of the first importance which demand solution ere much advance can be made. Notably is this the case in the matter of what kind of rays are of most advantage—whether the “x-rays,” “cathode rays,” or a combination of the two. He personally recommends the use

of a “medium” tube, and prefers to operate with the anti-cathode red hot. He avoids dermatitis by arranging the exposures suitably, and continues the treatment for three, four or five months.

Alan Jamieson, writing in the *Lancet*, in referring to the employment of hard or soft tubes in x-ray work, states that he has found that weather affects the rays materially, e. g., on cold, raw days reactions more readily occur. Wild, in the *Medical Chronicle*, has grave doubts as to the prophylactic value of the x-rays in preventing recurrence after operation for cancer. A case of splenomedullary leukemia reported in the *Medical Record*, August 22, 1903, has been treated by Nicholas Senn with great success, and other similar cases have been since reported.

On the whole, notwithstanding the many instances in which skin diseases, and even malignant diseases of a superficial nature, have been treated successfully by this means, it is as a diagnostic agent that the x-rays have yielded the most brilliant results. As remarked before, however, we are only upon the threshold so far as the use of electricity in medicine and surgery is concerned.—*Medical Record*.

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DR. NIELS FINSEN.

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## Report on N-Rays.\*

BY ANDRE BROCA.

It is a dangerous task at present to make a report of the n-ray. This question, almost grown old in a year, is strongly controverted. Certain persons have gone so far as to deny the existence of these rays. This is in consequence of the difficulty and extreme delicacy of the observation of n-rays, and because the technic necessary is truly over-refined. I began to work on this subject in January, and I was not able to see the phenomena until about six weeks ago. It seems a unique experience in the history of science to find that phenomena which are so difficult and delicate to observe are at the same time so important theoretically and practically. However, the same thing has occurred in connection with auscultation, with the microscope, and with the work of Pasteur. In all of these cases a new and delicate technic must be mastered and new methods must be employed. Doubts are raised which influence even the best of men, and truth has great difficulty in making headway. Again, it must not be forgotten that in making experiments on the attraction and repulsion of electrified balls the experiment will often be a failure, but this does not impeach our electro-technic.

The following observations on the

n-rays are incomplete, subject to errors, the causes of which had to be learned from day to day, and which were very frequently due to the existence of n-rays under conditions very difficult to anticipate. It is because I failed to strike the same difficulties daily after I had found the explanation of my mistakes that I am emboldened to say a few words on such a difficult subject. I make no pretense of giving a complete and adequate exposition; I give only a few shots upon the theory; but I do emphasize the technic and the difficulties encountered for the purpose of placing in the hands of physicians a useful instrument. In this account of my work I have referred to many things, some of which are only provisional; others approach the great verities of science. I also admit some possible errors. I have not written this paper for the purpose of giving my personal experience, but to give what I know to be for the best interest of science and medicine.

### DISCOVERY OF THE N-RAYS.

In 1904 Blondlot believed that he had measured the speed of the propagation of x-rays, making use of their action upon a small spark, which gave greater brilliance when the rays emanating from a Crookes tube fell upon it. He found that what influenced the spark propa-

\*Translated from *Archives D'Electricite Medical* by J. Z. S. Maywood, D. es. Sc.

gated itself with the speed of light and that it was also polarized. The spark is active when the conductors which produce it are in the same plane with the cathode ray generator and the line of observation; it is inactive when in the perpendicular position. The plane of polarization is turned by the action of quartz or by a piece of sugar. But the facts of polarization and rotation as above prove the existence of two circular rays, comporting themselves, after the law of Fresnel, precisely like quartz, rotating respectively to the right and left and propagated with different velocities. Blondlot found that the rays which influenced the sparks were refracted by a prism of quartz, having an index of about 2, differing from the x-rays, which are not deviated by the prism. In the above experiments he measured the velocity of propagation, not of the x-rays themselves, but of radiations, both refrangible and polarizable, which are found mingled in the tube with the x-rays. To these rays Blondlot gave the name of n-rays, and the fact that they have the same velocity as light shows that they are analogous to light, or, at least, are related to electro-magnetic undulations of the same species as the light or waves of Hertz.

With a quartz lens distinct foci are obtained, proving either a good emission of a discontinuous spectra of the n-rays, or a good selective absorption by the quartz of the radiations emitted by the Crookes tube.

Leaving the question open relative to the emissions of the Crookes tube for the present, we will direct our thots toward the rays which were observed to deviate.

#### N AND $N_1$ RAYS.

For readily observing the action of the n-rays on small sparks, Blondlot placed

at a distance of some centimeters from the spark a piece of unpolished crown-glass and studied the variation in brightness, both directly by the eye and by photography. The apparatus must be carefully and accurately adjusted, and, above all, the distance perfectly regulated. We employed as the source of electricity the secondary, wrapped with medium wire, of a Du Bois-Raymond coil, placed about four centimeters from the maximum position; the coil was then excited by a single accumulator.

It is likewise useful for the observation of the light emitted by means of blue glass, for the modifications of the n-rays were especially produced in the emission of the blue rays. One should have a small gas flame, conveniently adjustable, so as to obtain a given condition to which the n-rays are sensitive, as shown by their variation in brightness. Then, again, they may be made to act upon a thin plate or wire of platinum rendered incandescent by an electric current, or, better still, upon a sheet of white paper clearly illuminated by means of a blue light (Gutton).

But the most convenient procedure consists in the employment of sulfid of calcium, rendered phosphorescent by light, and of which we observe in darkness the variations of phosphorescence under the action of n-rays.

The latter procedure, whose technic is so simple, has made it possible for the n-rays to exhibit themselves thru a considerable range. The other procedures are still more difficult, and tho photography of the little spark permitted Blondlot to prove the existence of these rays; this is almost wholly impracticable for common use.

The employment of phosphorescence is



a far more delicate procedure than the others, and much more difficult; nevertheless, the technic will be described in detail. In a large number of cases the phenomena were observed on very small surfaces; for this reason Blondlot at first employed a hooded screen. For their construction he took a thick mixture of collodion and calcium sulfid, which he applied with a brush to pasteboard in spots about the size of a pea. The difficulty is to make the layer homogeneous, so as to be able to judge easily the exact difference in brilliance between them. The best practice is to make a small groove with a file in some solid that is transparent to the n-rays, wood or aluminum, in which the sulfid of calcium is placed. We thus have a clear line in which the modifications are well seen. Cover the whole with a coat of collodion in order to preserve the sulfid and to avoid oxidation by the air. If these directions are followed we should avoid all failure. I made an effort to replace the collodion with gelatin. The screens thus obtained were not durable, the sulfid rapidly falling off. In doing as has been described, we have a screen which, if always a little variable, is still permanent. However, the screens are much better when freshly made and when the sulfid of calcium has been recently prepared. I use only the best quality of sulfid and preserve it in a stoppered flask, or, better still, in a sealed glass tube. Sulfid of zinc can be used equally as well, but it is inconvenient because it loses altogether too quickly its phosphorescence. This renders its employment less easy, and it is also too costly. Each observer should form any kind of a design he prefers by means of these grooves, a small cross or diæsis, or, better still, several circular grooves.

On a screen of this kind, previously insulated and placed in a dark chamber, the beams are soft, and light as if bathed in a nebulous haze. The brightness is augmented under the action of the n-rays, at the same time becoming sharper. These two characteristics together bestow a greater visual acuity to the eye and permit one to discern much better the details of the screen. The observations should not be made immediately after the screen has been insulated. If this has been very strong the brightness is not affected by the action of the n-rays. One should wait a certain time, about one minute, to find it in the best condition. Nearly all observers have found this moment such the best and the screen under these conditions most brilliant. Occasionally it is possible to continue the observation for a quarter of an hour or even for half an hour, but this is a disadvantageous condition, and it is better to insolate the screen every five minutes in normal weather.

The artificial lights in general are bad for exciting the screen. One should when working in the evening use either the electric arc or the magnesium lamp, or Auer's burner without a glass. The ordinary lamps do not give good results. The observations should be made under diverse conditions, either in absolute darkness or, better, in relative obscurity. I have observed them equally well in both conditions. Blondlot advised the employment of a feeble yellow light to illuminate the screen. With this kind of a screen the luminous shafts which deviate, becoming a deeper blue under the action of the n-rays, were more easily seen. In fact, the yellow light should be so regulated as not to show the bluish light in the ab-

sence of the n-rays. It will appear under the action of the latter.

I will end this chapter by indicating the precautions, physiological and psychological, which must be taken in order to secure conviction in the observation of the n-rays. First of all, one gets his retina in a proper condition of sensibility. It ought to be, as far as possible, adapted to darkness or at least to a feeble light. No observation should be attempted immediately after coming from out of doors, nor immediately after somewhat severe physical exercise.

Experiments with the n-rays are much more difficult than the ordinary experiments in photometry, altho the differences to be judged are much greater. Really what one must decide in the experiments is the difference in the brightness which occurs successively on the same plate, and it is the memory which plays the principal role. We know how short is the memory for visual impressions; it is, therefore, very difficult to convince oneself of the existence of the n-rays at a given instant. One reaches complete assurance only after repeated experiments of an increase in brightness of the screen when it passes a determined point in space.

It is better when one believes he sees a difference in luminosity, in moving the exploratory screen, to choose two positions, between those points where you suspect the existence of n-rays, and to transport successively the screen from one of these positions to the other; let this be done by an assistant who instantly makes the change to the point indicated by you.

These experiments should never be made unless the observer himself directs the change. In fact, when you lend your unremitting attention to this work it is all but impossible to make the changes

uniform. It is sufficient, in order to convince oneself, to catch these luminous excitations on the threshold. You observe considerable of these variations (from one to three or four) from one moment to another, and this is what requires deep attention. All experiments of this kind should be made without forced attention; the first condition, then, is tranquility of spirit; above all, there should be no risk of a surprise, and in consequence should the observer himself order the changes of position, then he can observe in entire tranquility.

In order at all times to be able to know what changes of state permit one to be sure of the existence of a bundle of n-rays, one ought to inure himself to the use of certain suitably constructed absorbent screens. But this procedure is subject to errors which we can control if the various screens be always, according to circumstances, the same distance from the sources of the n-rays. One ought to bear in mind the fact that the phosphorescence is influenced by many things, principally by heat. The observation of physiological radiations may be completely spoiled by this factor. But one ought to be able to distinguish the two actions by their net differential characteristics.

The action of the n-rays on the sulfid shows a certain loss of time and this delay may continue for some seconds. But the delay is much less than occurs under the action of heat. Moreover, at the moment of the cessation of action the difference in the time lost becomes much greater.

There is still another property by which we can distinguish between the two effects. In the action of the n-rays the augmentation of luminosity does not appear unless one looks in a direction nearly normal to the phosphorescent surface.

When it is about 45 degrees no difference is perceived; on the contrary, when one observes below the plane of incidence the effects are transposed, there being a diminution of luminosity in that direction at the times that the normal emission is augmented.

We find, as we go along, a number of circumstances in which instead of an augmentation of luminosity under the action of the radiations of Blondlot there is, on the contrary, a diminution. Blondlot has given to the rays which produce this effect the name of  $n_1$ -rays. We shall see shortly the explanation, thru the presence of both  $n$  and  $n_1$ -rays in the same emissions of sulfid of calcium properly insolated, a peculiarity which has been described by Blondlot relatively to a difference of emission of sulfid in the two directions.

Leaving this question, we will return to the practical application. Macé de Lépinay has proposed to make a screen of sulfid of calcium with a thin plate bent at an angle less than a right angle, the two sharp faces to be unequal in size. The small face is then placed normally to the source of the  $n$ -rays, and the large face receives them very obliquely. One can also, following the author, work as in the case of ordinary photometry—that is, to estimate the difference in brightness of two neighboring plates. I have not attempted personally this procedure and hence can not pronounce judgment upon it.

#### VARIOUS METHODS OF PRODUCING N-RAYS.

With these means of observation one can test nearly all the sources of light. In particular the Auer burner and Nernst lamp emit both  $n$  and  $n_1$ -rays. The sun emits them very intensely.

Besides the ordinary sources of radiations which emit at the same time both light and  $n$ -rays, there have been found a great number of other sources of  $n$ -rays. Jégou found  $n$ -rays emitted by the liquid of a Leclanché cell in activity. Colson has excited it in certain chemical reactions, as, for example, when  $\text{KOH}$  is poured into a solution of  $\text{ZnSO}_4$ , then we have the  $n$ -rays (there is no radiation produced on pouring  $\text{ZnSO}_4$  into  $\text{KOH}$ ). This is caused by the formation of complex basic salts in the first reaction, which are not produced in the second. Hence, one can say that Blondlot's rays are produced by many chemical reactions.

Likewise in the phenomena of imbibition, one should use in  $n$ -ray experiments moistened cardboard to form the screen. In this procedure it is not well to use the damp screen for observation too soon after it has been moistened, for in this case it will be itself a source of  $n$ -rays. Moreover, one should never fail to verify directly a screen after having used it, otherwise one is exposed to grave errors.

One extremely powerful source of  $n$ -rays is sulfid of calcium insolated by submission to another source of  $n$ -rays. We have here an explanation of the augmentation or the diminution of visibility by the action of the  $n$ -rays on the human eye. Practically we obtain a powerful source for  $n$ -rays in insulating the sulfid and then observing the rays emitted from it thru a slit of some other substance, as aluminum, for example.

Heretofore we have considered the emission of  $n$ -rays by ordinary sources of radiation or, at least, by those sources in which we immediately comprehend whence the energy proceeds. But one can also observe them under extraordinary conditions, emitted by bodies in forced



equilibrium, and that during an unlimited time. Thus it is that tempered steel, bent wood, stretched wire and Rupert's drops are indefinite sources of n-rays. Blondlot possessed a tempered cutlass of the time of the Merovingians which emitted n-rays for actually an hour.

We have not the space at our disposal to mention all the sources of n-rays which have recently been discovered, e. g., the liquefaction of gases (Bichat), the poles of a voltaic pile (Bichat), etc. Indicating merely certain peculiarities where the variations of brightness of the sulfid appear without one being able for the present to say truly that they produce n-rays, for example, when the sulfid is

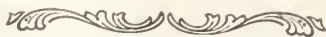
placed in a non-uniform magnetic field (Gutton), or near a sonorous body (Macé de Lépinay).

But we have kept for the last the most interesting fact for the readers of this journal, the discovery, made by Charpentier, in December, 1903, that n-rays are emitted by all animal organisms, especially when in a state of activity.

Edouard Meyer has extended this statement to include plant life.

We will only mention these here, reserving the right to take them up fully after we have studied the physical properties of the radiations.

(To be concluded.)



#### **Kryptol, a New Substance for Electric Heaters.**

United States Consul-General Frank H. Mason, at Berlin, Germany, describes in a report a resistance material recently invented for heating purposes. This has been designated as kryptol. The new substance is a mixture of graphite, carborundum and clay, so combined as to form a loose, granular mass of powder of different grades.

This substance is used as the conducting material in various forms of electric heaters. One form, adapted for cooking purposes, consisting of a porcelain tray about two feet square, with two carbon electrodes fixed at opposite sides. The kryptol powder is spread over the surface of the tray to a depth of about one inch. Coming in contact with the electrodes, it closes the circuit, and in a very short time is raised to incandescence. The cooking utensils may be placed directly upon this, and the amount of heat is regulated by brushing to one side as much of the

material as is not needed, or by varying the depth of the powder on the tray. The greatest heat is developed where the layer of kryptol is thinnest. When it is desired to discontinue the heat, the circuit is broken by brushing the powder away from one of the electrodes.

Other forms of heaters for warming rooms are constructed in somewhat the same style as steam radiators, the device consisting of a cast-iron, flanged radiator, the interior of which is glazed so as to insulate the kryptol mass with which it is filled. At each end of the radiator an electrode—usually of gas carbon—is introduced. An ordinary heater of this type takes from four to five amperes at 120 volts.

This substance is being used in industrial work, for annealing metals or for any purposes requiring an easily regulated source of heat. The kryptol, it is said, will withstand any temperature up to 3,000 degrees centigrade.—*El. Review.*

## Some Newer Conceptions of the Nature and the Management of Bright's Disease.

Abstract of a paper by ALFRED C. CROFTAN, M. D., Chicago, Ill.

*Nomenclature and Definition.*—The terms Bright's disease, nephritis and even albuminuria are not uncommonly employed synonymously. It appears almost trite to correct this popular misconception by the statement that Bright's disease is a systemic disorder that usually, but by no means invariably, produces nephritis; that nephritis is often due to Bright's disease but may also be due to a great number of other causes; and that albuminuria is a common, though not a constant, symptom of any form of nephritis. The term "Bright's disease of the kidney" is, therefore, not tautological, as many claim, altho "the kidney of Bright's disease" would be a more correct expression. The term Bright's disease could with advantage be altogether eliminated from modern medical nomenclature, for what Bright originally described includes many renal disorders that have since been shown to be morbid entities *sui generis*. To retain the term, therefore, means confusion.

The cardinal symptoms of Bright's disease in the newer sense are, in the order of their frequency and sequence, (1) cardio-vascular; (2) nephritic; (3) cerebral; (4) retinal.

The cardio-vascular signs must appear first. The old idea that the kidneys are always primarily involved, that as a result of renal inadequacy certain excrementitious bodies are retained, and that these produce the changes about the heart and arteries, the eye ground, the brain, does not apply to Bright's disease as I interpret it. This sequence of events un-

questionably occurs in many forms of nephritis, but these are not Bright's disease, for many nephritides run their course without cardio-vascular changes; above all, without retinal or cerebral symptoms. In Bright's disease there is always increased arterial tension, always some accentuation of the second aortic sound, always some hypertrophy of the left heart—and in fact, I do not think we should diagnose Bright's disease without such cardio-vascular changes.

The intoxication of the heart and arteries, with the resulting high blood pressure, leads to nutritional disorders in different parts of the body. It is not surprising to find that particularly those organs that are supplied by *end arteries* are chiefly involved, for in them vascular disturbances must first produce nutritional derangements. Chief among the organs supplied by end arteries are the kidneys, the retina, and the brain, and I think this explains the frequent involvement of the kidneys, eyes and brain in Bright's disease.

The fact that the retina and the brain are often injured before the kidneys, that cases of Bright's disease run their fatal course occasionally with practically no renal changes, but with serious apoplecticiform brain lesion and retinitis, bears out this conception and constitutes a valid argument against the common belief that the nephritis is the primary event and the determining phenomenon of the disease.

Further than this, always conceding

(as one must, I believe, nowadays) the toxic origin of Bright's disease, no specific susceptibility of the kidneys, the retina and the brain to the toxins that produce the disease need be postulated, for the involvement of the arterial system alone, as outlined above, would in most cases determine changes in these organs.

That various symptoms, that one might call tertiary, follow the nutritive and degenerative changes in the various organs affected, need hardly be emphasized. I refer, e. g., to the edemas, the retention of solids and water, and the other evidences of renal inadequacy that are consecutive to the nephritis.

#### CAUSES.

I am an ardent convert to the belief that Bright's disease is produced by circulatory toxins. Of the exact chemical character of these poisons we know very little. Their presence, however, is clinically revealed to us by their manifestations. There seems little doubt from the experimental evidence at our disposal that many of them are intermediary products of metabolism, poisonous precursors of non-toxic terminal products, that have escaped complete oxidation. I refer, for instance, to the group of purin bases, including such bodies as xanthin, hypoxanthin, etc., that are normally converted into innocuous uric acid and eliminated as such. These purin or alloxuric bases, as I showed in 1900 ("The Role of the Alloxuric Bases in the Production of the Cardio-Vascular Changes of Nephritis," *American Journal of the Medical Sciences*, 1900), are capable, when injected in small doses for long periods of time, of producing the changes about the heart and arteries and kidneys that are so characteristic of Bright's disease. Many other products of perverted or arrested metabolism,

as well as several of the inorganic salts when present in excess, and some poisons of gastro-intestinal origin, are capable of exercising the same effect.

The source of these bodies is twofold, namely, the gastro-intestinal tract and the proper tissues of the body. There is no more prolific source of poisons than a disordered bowel. Digestive disorders not only directly lead to the formation in the intestines and the absorption into the blood and tissue juices of a mass of abnormal and highly toxic degradation-products of the proteids, fats and carbohydrates of the food, but they also indirectly lead to hepatic insufficiency, a disorder that is most prolific in causing a flood of poisons to circulate thru the organism. It is not surprising to find that the liver cells are so often impaired in their function when the gastro-enteric tract is disordered, for all the poisons generated there are sucked up by the root tendrils of the portal tree, and are carried thru an intricate labyrinth of closely interwoven capillaries around and thru and into each hepatic cell; for a time the latter can withstand the stream of toxic matter and can properly exercise their disintoxicating function, but an overwhelming mass of putrefactive material flooding them at one time, or small quantities of putrid excrement irritating them chronically, must needs impair their function and render them inadequate to protect the organism as a whole from bowel poisoning. When this occurs, intestinal toxins filter thru into the circulation beyond and there can exercise their deleterious effects upon the heart, the arteries, and also those organs that chiefly supplement the disintoxicating function of the liver by eliminating poisons, namely, the kidneys.



One other consequence of this hepatic insufficiency is the incomplete elaboration of the aforesaid intermediary products of metabolism that reach the liver from the general circulation. When the liver cells can no longer properly perform their many functions because they are poisoned from the bowel, then these bodies that circulate around each hepatic cell in a network of lymph and blood channels as intricate as the capillary branches of the portal system can no longer be converted into innocuous end products, like urea, uric acid, creatinin, etc., but are returned to the general circulation unchanged as poisonous ammonium salts, purin bases, and a host of other bodies that, unless rapidly eliminated thru the kidneys, produce a chronic auto-intoxication.

Finally, the character of the bile becomes changed, its physical properties are perverted, it no longer flushes the bile channels in a broad stream, but often becomes more thick and viscid, so that some diapedesis of poisonous bile-constituents from the bile into the blood capillaries occurs; the change in the quantity and composition of the bile reduces its germicidal power and hence intestinal putrefaction is increased, or, at least, not checked; constipation supervenes, right disassimilation of the enteric contents is prevented; the assimilation of fats is decreased, and consequently the general nutrition is disturbed. In this way a vicious circle is closed, and both in the bowel and in the tissues at large poisonous bodies continue to be formed that are capable of producing numerous disorders, among them many of the symptoms of Bright's disease.

#### TREATMENT.

Based on the above conception of the gastro-enteric, and by implication, hepatic

origin of many cases of Bright's disease, an intelligent prophylaxis and a conservative treatment of early stages of the disease should be directed toward the correction of the disorders in the bowel and the liver. I am a firm believer from my clinical observations in the digestive origin of many—I might say most—cases of Bright's disease, and I believe that in numerous cases early attention to the digestive tract will check the progress of the disease, and not infrequently produce a nutrition to normal even when the heart is already considerably hypertrophied, and when the kidneys are already showing evidence of nephritis.

Symptomatic treatment in Bright's disease is not, however, the conventional treatment of the kidneys, but the treatment of the *heart* and of the *arteries*. This is clear from what has been stated above. Later, when nephritis is established, it becomes necessary, of course, to counteract the bad effects exercised upon the organism as a whole by inadequacy of the renal functions.

The management of Bright's disease may fitly, therefore, be discussed under these several heads: (1) Prophylactic and causal, directed against the perversion of the digestive and hepatic functions; or, when possible, against the development of the aforesaid obscure metabolic disorders. Second, symptomatic, directed primarily against the development of cardio-vascular changes; secondarily, against the results of nephritic changes. The symptomatic treatment of the common cerebral and retinal changes is synonymous with the treatment of the heart and arteries. Finally, treatment of the patient as a whole is of paramount importance, particularly as regards the maintenance of general nutrition by adequate,

if necessary, mathematically regulated feeding, and as regards the conservation of a hopeful mood, and the prevention of those great perversions of all functions, viz., depression, fear and worry.

*To Prevent Intestinal Putrefaction.*—

Aside from the common dietetic rules, the lavage of the stomach, etc., two remedies have been found to be of particular value, viz., the sulfo-carbolate of zinc and the bile acids. While neither of these substances constitutes an intestinal antiseptic, I do believe that the proper administration of either of these drugs can check at least the putrefactive decomposition of albumins; and as the albumins furnish the bulk of the most toxic intestinal bodies something is gained thereby. I have been in the habit of giving the sulfocarbolate of zinc in one grain doses at frequent intervals, together with some twenty grains of bismuth subnitrate in the twenty-four hours. The bismuth salt I utilize merely as an indicator of the action of the sulfocarbolate of zinc, in the following sense: It is well-known that the putrefactive disintegration of albumin leads to the formation of sulfids; the latter combine with bismuth salts to form black bismuth sulfid, hence the administration of bismuth by mouth practically always leads to the formation of black stools, because there is nearly always some putrefaction going on in the bowel. If, however, sufficient sulfocarbolate of zinc is given, all putrefaction will stop, and the stools, despite the administration of bismuth, do not become black. The proper dose, therefore, of sulfocarbolate is *enough* to prevent the formation of bismuth sulfid in sufficient quantity to color the feces. When this is accomplished it will be found that the urinary evidence of bowel putrefaction also dis-

appears, as manifested by the reduction of the indican, and other conjugate sulfates, the compound glycuronates, and the compound glycochols.

The administration of bile salts is of value, because these bodies possess marked germicidal properties and, moreover, constitute a very efficient cholagogue and stimulant of the hepatic function. Their administration may, therefore, be imagined to aid in combating casually and directly the development of hepatic insufficiency and its consequences. At all events, their effect upon the constitution of the feces and the urine as far as the elimination of putrefactive bodies is concerned is almost as marked as in the case of sulfocarbolate of zinc.

I have so far been unable to find that other so-called intestinal antiseptics act as well or as rapidly as the two named bodies.

*To Strengthen the Heart and Reduce the Blood Pressure.*—

Notwithstanding the chronic character of Bright's disease, I am not afraid to give digitalis from the beginning, and to continue its use for years. Large doses are unnecessary and even harmful, because the heart is already over-stimulated, but small doses, and by this I mean one drop of the tincture three times a day, influence the heart's action in a favorable manner, not by prolonging the diastole and enforcing the systole, but by rendering the heart less susceptible to the disturbing stimulation of circulating toxins. That digitalis possesses this power has been demonstrated experimentally. I give small quantities of digitalis not, therefore, in order to stimulate the heart, but in order to regulate it and to protect it from the effects of a chronic intoxication. The heart does not thereby lose its power to respond to larger doses

of digitalis, so that the objection that one should reserve digitalis to the last, in order to "have something in reserve," becomes invalid.

Better than digitalis and its congeners is the exercise treatment of a heart in Bright's disease that needs stimulation and whose muscle tone is beginning to flag. A Schott treatment often accomplishes wonderful things in Bright's disease; unfortunately it is not easy to carry out unless one can absolutely control the patient. Where I have been able to apply it the results have been excellent thruout, even upon the kidneys; the albumin almost invariably decreases, and the excretion of solids increases within a short time.

To reduce the blood pressure, nitroglycerine is the favorite remedy, and justly so. I have recently begun to use erythrol tetranitrate, a preparation that seems to grant a prolonged vaso-dilator effect. It is good practice to keep patients under the influence of this drug for long periods of time, particularly if one is attempting in the meantime to discover and remove the underlying cause of the increased arterial tension. As far as the nephritic manifestations are concerned, vaso-dilation is of much value, for one may, I believe, say axiomatically that as soon as the blood pressure falls in the kidneys the albuminuria decreases, and the renal epithelia regain their tone and become better able to perform their function.

Valuable adjuvants to the drug treatment of high arterial tension are certain physical means, and I can not say enough in praise of the hot bath, rest in a warm bed, judicious exercise and massage: in fact, of any measure that causes prolonged dilatation of the superficial blood vessels. To enter into the finer mechan-

ism of this effect, to discuss the exact indications for the employment of these different measures in varying individual cases, would lead me too far.

*Four points in the treatment of the nephritic manifestations of Bright's disease* I wish to emphasize, because they are modern. I refer (1) to the use of a more liberal diet; (2) to the restriction of liquids; (3) to the withdrawal of chlorids; (4) to the so-called surgical treatment of Bright's disease.

*Liberal Feeding in the Nephritis of Bright's Disease.*—In feeding any case of nephritis, two fundamental axioms should be followed, viz.: (1) To give a diet that is least irritating to the kidneys. (2) To adequately nourish the patient; for by following the first rule we place the kidney, relatively speaking, at rest, we spare the diseased organ; by following the second rule we bestow upon the organism as a whole sufficient strength to combat the disease process, and to undertake regeneration where degeneration has taken place. In all acute forms of nephritis that run a short course the sparing of the kidney is the most important task, as the organism has enough reserve pabulum in storage to maintain adequate nutrition during the short duration of the disease; in such cases underfeeding or even starvation of the patient is not only permissible, but good practice, for the less of excrementitious material the kidneys are forced to eliminate the more rapidly do they resume their normal function. One may say in a broad sense that the daily amount of feeding, expressed in caloric value, should be inversely proportionate to the presumable duration of the nephritis. Hence the more chronic the nephritis, the more nutritive should be the diet, and as the nephritis of Bright's is the most



chronic variety we have to deal with, a case of Bright's disease should receive daily the full caloric value in his diet that is required to maintain nutritive equilibrium, i. e., at least thirty calories per kilogram of body weight.

Whereas, therefore, in certain acute and subacute forms of nephritis a milk diet is permissible, even useful—for, I may add in parenthesis, a milk diet reduces intestinal putrefaction and hence removes a prolific cause of renal irritation—such a regime, as I have pointed out elsewhere (*The Dangers of an Exclusive Milk Diet*, etc., *Medicine*, May, 1903), is to be condemned in the chronic forms of nephritis, and in particular in the nephritis of Bright's disease.

There is, moreover, no compelling reason why a mixed diet should not be given. It is puerile and altogether unscientific to postulate that the albumin given by mouth should appear as such in the urine, and that the more albumin the patient eats the more will he secrete—and still this prejudice exists in the minds of many. A diet containing variety and above all a diet of sufficient caloric value to nourish the patient should be carefully selected, and only those articles excluded that we know lead to the formation of urinary end products that are eliminated with difficulty, and hence can be assumed to irritate the kidneys when they are diseased. The details of this selection can not be given within the narrow frame of this article.

*The Restriction of Water Drinking.*—This point has been touched in discussing the dangers of an exclusive milk diet above. Regarding Bright's disease as a primarily cardio-vascular affair, it stands to reason that the flooding of the heart and arteries with much liquid can only

increase the arterial tension, and overwork the heart. It is common practice to give much water in all forms of nephritis (witness the many waters on the market that are sold as "cures" for Bright's disease, etc.), the object being presumably to "flush out the kidneys." I regard this as fictitious, excepting in the convalescent stage of certain clearly circumscribed varieties of parenchymatous nephritis. The first thing the kidneys stop eliminating when they become diseased is water, hence water in this stage passes the kidney parenchyma with difficulty, and to attempt to force it thru is to irritate the kidneys when they should be kept at rest.

That water is irritating to the kidneys when they are diseased is manifested by the good effects exercised in many cases of nephritis by sweating. There is no evidence to show that the sweat of nephritics contains much of toxic bodies; it does contain some urea, a moderate quantity of common salt, and above all abundant water. The chief advantage, therefore, of sweating seems to be to rid the organism of the *water* that the kidneys can not properly eliminate. The common habit, therefore, of sweating a patient, on the one hand, and giving him abundant water, on the other, is irrational, for to do this is to neutralize the good effect of the sweating, to irritate the kidneys and to overtax the heart and arteries. I have made it a broad rule to gauge the the water intake largely by the water output—carefully considering all the while the particular requirements of each case. I never force water drinking, but am always more inclined to restrict fluids.

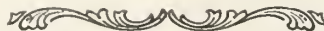
*The Withdrawal of Sodium Chlorid.*—It is a well-known fact that nephritic kidneys commonly fail to properly eliminate

sodium chlorid, i. e., ordinary table salt. A very ingenious theory has been advanced to show that this retention of chlorids in nephritis can in part be incriminated with the production of edemas; the idea being that sodium chlorid in the tissues requires a certain amount of water to hold it in solution in such dilution that the normal molecular concentration, i. e., the osmotic pressure, of the blood and tissue juices is not changed (one of the chief functions of the kidney being that of an osmo-regulatory apparatus, intended to eliminate salts when the blood concentration becomes too great). It is postulated that the sodium chlorid retained in the tissues draws water from the blood by a process of osmosis, and that hence edemas develop. Basing on this theory, the attempt has been made to restrict the ingestion of chlorids, i. e., to withdraw table salt from the diet for the purpose of reducing edemas, by giving the kidneys a chance to slowly get rid of the accumulated chlorids. Clinically this experiment has quite often given favorable results, and I have, in common with many others, repeatedly seen edemas disappear (and incidentally albuminuria often decrease) when the chlorids were excluded from the food. On the other hand, edemas in such cases can often be caused to reappear when salt is again given. As 100 grains of common salt require about three pounds of water to form the proper physiological solution in the body, it is clear that any sudden increase in the weight of the patient may mean

salt—and hence water—retention and should put us on our guard above all for deep edemas and should induce the careful clinician, tentatively at least, to withdraw the chlorids from the food.

*The So-called Surgical Treatment of Bright's Disease.*—The operation of decapsulating or splitting the kidney for the cure of Bright's disease may be mentioned merely to be condemned as altogether irrational. I fail to find in the literature a single case that could clinically be considered a true case of Bright's disease that has ever been permanently benefited by decapsulation of the kidney. The majority of case reports are so inaccurate, as far as the diagnosis of the disease is concerned, that they are practically without value.

[Excellent results are claimed in Bright's disease by the use of electricity alone. But however this may be, to Dr. Croftan's thoroly sensible suggestions should be added some others regarding electro-therapeutic measures that can be used to good advantage. In the first or eliminative stage of treatment the high-frequency current; either by the Oudin resonator, the couch, or the large helix; assists both by promoting perspiration and by its destructive influence upon the toxins. Afterward the general tonic effect of "positive insulation" with a static machine, and the local stimulus of a strong galvanic and sinusoidal current sent thru the liver, kidneys and bowels, are extremely useful.—EDITOR.]



# Electrotherapy in Diseases of the Eye.

BY W. H. WALLING, A. M., M. D.,  
ATLANTIC CITY, N. J.

*Conjunctivitis, etc.*—In all acute inflammations of the lids or of the eyeball, the galvanic anode may be applied to the closed lids with an intensity of two to five milliamperes for five minutes to each eye, once or even twice daily. The cathode should be placed upon the back of the neck, over the second and third cervical vertebra.

The anodal static breeze from a pointed wooden electrode is also very beneficial in inflammation or irritability of the eyes. Eye waters or other physiologic applications are of course in order. As this paper is confined to the consideration of physiologic therapeutics, the purely medical treatment will not be discussed.

*Trachoma.*—This may be treated in two ways: By means of a copper or zinc electrode, as it is technically called, Metallic Electrolysis, and by the anodal needle. If by electrolysis, the granulations are to be carefully but thoroly gone over with a flat copper or zinc electrode (copper preferred), attached to the anode of a galvanic battery. Only a sufficient number of cells are to be included in the circuit to carry the required current, which should not exceed two to five milliamperes, applied for two minutes, daily. In some severe cases the application may be much stronger, say ten to fifteen milliamperes, for a few seconds only. Every part should be acted upon in a greater or less degree.

If the retrotarsal fold be involved, as it frequently is, install a solution of holocaine into the eye, protect the ball by means of a thin tortoise shell or hard rubber blade and then pass a thin copper

electrode over the inner lid with a current intensity of three to five milliamperes for three minutes. The instrument must be kept moving over the surface in order to prevent its adhering to the same. Every other day will be frequent enough, and once a week, if a strong current be used.

A more effective way is to treat each granulation with a platinum needle connected with the anode of a galvanic battery. Two to four cells will be sufficient as a rule. The needle is to be inserted into each granulation and destroyed by electrolysis. As the needle will adhere to the tissue, the polarity of the battery must be changed for a few seconds before attempting to remove the needle. Before attempting to reverse the current it must be turned completely off, then reverse it by means of the commutator, remove the needle, reinsert it, again change to the anode, turn on the current and proceed as before.

All electrodes should be thoroly disinfected after being used, as trachoma is highly contagious.

*Tumors of the Lids.*—If cystic, open, turn out the contents and act upon the interior with a small cathodal electrode with an intensity of ten milliamperes for one or two minutes. The entire surface should be cauterized, causing adherence of the surfaces with obliteration of the sac.

*Wild Hairs.*—These are to be removed by electrolysis. A small steel needle may be used, as only the cathode is admissible in electrolytic work of this character. A current of one or possibly two milliamperes will be sufficient, to be passed until



the hair can be removed without traction. Only a sufficient number of cells should be included in the circuit to carry the required current. A bowl of water in which the anode is immersed should be placed so that the patient may dip one finger at a time until sufficient contact has been made, after the needle has been introduced. Sudden makes or breaks of the current while the needle is in position will cause discomfort. If more than one hair is to be removed, do not act upon any in close proximity to each other; too much irritation will result. This will also apply to facial work as well.

*Cataract.*—Much may be accomplished in this affection, and in some cases the sight may be nearly if not quite fully restored. One electrode is to be placed upon the closed eyelid and the other on the back of the neck, over the second and third cervical vertebra. A cotton covered disc one inch in diameter will be large enough for the eye. Both pads should be well wetted. The eye pad may also be wetted in a solution of cocaine, if deemed better. Having the electrodes in position, turn on a current strength of three to five milliamperes for five or ten minutes, changing the polarity every two minutes, without shock, invariably closing with the cathode on the lid. This frequent change of polarity is highly conducive to absorption of the cataract, as the anode contracts the blood vessels while the cathode relaxes or expands them, thus causing a comparatively rapid change in the character of the lens. The combined current may also be used in the same manner.

If a solution of potassium iodid be used on the eye, as I sometimes do, the change of polarity can not be made, as the iodid can only be used on the kath-

ode. The treatment of cataract should be given every other day for a year or more, with occasional intervals of cessation for a few days. Senile cataract seems to be more amenable to this method of treatment than other varieties.

*Optic Atrophy.*—The treatment of this condition is the same as for cataract excepting that potassium iodid is not used. Treatment must be persisted in for quite a long time. Of course, strychnia and other appropriate remedies will be administered.

*Asthenopia.*—This is one of the most common and at the same time one of the most obstinate conditions with which we have to deal. It is characterized by a certain weakness, with inability to use the eyes in spite of a careful correction of the anomalies of refraction if they exist. Sometimes the ocular muscles are at fault, yet the correction of such defects do not always give relief. The treatment consists in absolute rest for a few days and the daily application of the galvanic anode to the closed lids, either by double cups or singly. The cathode is to be placed upon the back of the neck and a current of two to three milliamperes passed for five to ten minutes every other day. If a galvanic battery be not available, a faradic battery may be used, giving a mild secondary anodal current, as with the galvanic. Static insulation and the anodal breeze from a pointed wooden electrode or the finger tip, gives good results.

*Corneal Opacities.*—In the treatment of this condition the galvanic current only is to be used. It may be applied through the closed lids, but better results are obtained by acting directly upon the opacity with metal or carbon electrode. The one most adaptable to this purpose

was made for the writer by Mr. Otto Fleming, of Philadelphia. It consists of an insulated handle terminating in a spiral spring, bent at an angle of sixty-five degrees, upon the end of which is another insulated attachment with a metallic, cup-shaped portion, which is the active part. The cathode only is to be applied to the eyeball. A 4 per cent solution of holocain is to be instilled into the eye, after which the application may be made. A current strength of one or possibly two milliamperes may be used, carefully watching the effects. But little should be done at each sitting, which should be only for one-half to one minute. As a rule there must be but a scarcely perceptible electrolytic effect upon the cornea, the intent being to stimulate the tissues into absorption of the exudate. The process is slow, but is, in most cases, very effective.

*Corneal Ulcers.*—These are to be treated much in the same manner, but with a small, pointed copper or zinc electrode, very lightly touching the ulcer with the anode, or by passing the anodal current thru the closed lids. Beginners should adopt the latter method.

*Pterygium.*—Insert a small platinum anodal needle into the narrowest part of the growth and cut off the blood supply. A current of two to three milliamperes will suffice, allowing it to pass until the part turns white, say two to three minutes. Turn off the current, reverse the polarity of the battery by means of the commutator and allow it to pass for a few seconds to allow the needle to be easily removed. One application will be sufficient, if carefully done.

*Stricture of the Nasal Duct.*—Electrolysis is an ideal method of dealing with this condition, but one must be careful

not to attempt too much. The punctum is to be slit as for ordinary probing. Pass a probe, if one can be so used, then select one a size larger, insulate a portion of it so as to protect the punctum, attach it to the cathode of a galvanic battery, insert until resistance is met with, turn on three to five milliamperes of current and gently pass the probe electrode down the canal, allowing it to act upon the same for one or two minutes, at the same time moving it slightly up and down. Sitzings may be held once a week, using a larger probe each time until the canal has been sufficiently enlarged.

Of course, if the stenosis has been caused by a bony growth or enlargement, electrolysis will not be advisable.—*Medico-Chirurgical Journal.*

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**Physiological Rays and Wires.**—M. Charpentier, who claims to have discovered that N-rays are emitted by the living body, states that other rays are also associated with them, and some of these can be transmitted by wires. In the *Comptes Rendus*, January 25th, he describes the following experiment. A small disc of thin copper (called the transmitter) communicates by a copper wire with the phosphorescent screen used to detect the rays, the wire, in fact, being twisted a few times round the screen. The disc was from one to two centimetres in diameter, and the wire nearly a metre long, but it might be much longer. The screen was fixed in the corner of a dark room, and the disc at the other end of the wire was free. When the disc was placed near a living body the screen glowed brightly. This occurred whatever the form of wire or the obstacles between the disc and screen. An electric screen,

such as a plate of copper or aluminum, joined to earth, when interposed, arrested the radiations. Insulated metal plates did not arrest them. He concludes that physiological rays can be transmitted not only direct through air, like rays of light, but along metals, like electricity. Such sources of N-rays as tempered steel, he says, emit rays having this double mode of propagation. This discovery will be useful in the further investigation of these rays by making the screen, a copper plate covered with phosphorescent sulfid of calcium and attaching it to one end of the wire, the other end being free to apply to points of the body—for example, the different parts of a nerve. A small copper disc on the free end may be used for exploring larger areas of the body.—*Ex.*

**Wehnelt Interrupter.**—Hauser has found that the rate of interruption of the Wehnelt interrupter may be greatly increased and its starting potential lowered by using dilute sulfuric acid and adding to it 20 per cent of its weight of sulfate of magnesia. With sulfuric acid solution of 1.05 specific gravity, the maximum current is lowered from nearly forty amperes to 12.5 amperes at 118 volts, and the starting of the interrupter occurs at twenty volts with 5.5 amperes. A still lower starting current is obtained with a half saturated solution of sodium bichromate, to which 11 per cent by volume of sulfuric acid is added. The interrupter in that case works with only 3.5 amperes. The starting voltage (fifty volts) is, however, much higher than in the case of magnesium sulfate. The depolarizing liquid used in the Radi-guet cell, consisting of 120 grams sodium bichromate, 250 cc. sulfuric acid and 720

cc. water, gives a starting voltage of twenty, a starting current of twelve amperes and a maximum voltage and current of 118 and forty respectively.—*Soc. Física y Química, Madrid*, May 25; abstracted in *Lond. Elec.*, August 7th.

#### Roentgen Rays in the Manufacture of Cables.

A very neat application of Roentgen rays in cable manufacture is described in *Electro* by Herr W. Otto. The chief value of this apparatus is in detecting foreign substances and imperfections in the rubber or gutta-percha insulation of electric cables. The apparatus is of particular value in preparing submarine cables, since here defects which might ultimately give much trouble and cause great expense for repair are easily detected. The device consists of a table containing the necessary regulating apparatus. On this a Roentgen tube is fixed, and above it is placed the fluorescent screen. The cable to be examined is passed through guides which conduct it just below the screen, so that the shadow of the cable is thrown upon the screen. This arrangement allows the cable to be passed through the testing apparatus quickly. Any foreign substances or a bubble of air, or even a bad joint in the rubber is at once shown. It is convenient to have the apparatus portable, so that it may be taken to any part of the works.—*Elec. Review*.

If my next door neighbor chooses to have his drains in such a state as to create a poisonous atmosphere, which I breathe at the risk of typhus or diphtheria, he restricts my just freedom to live just as much as if he went about with a pistol threatening my life.—*Huxley*.



### The Progress of Cancer Investigation.

The announcement from London, by three observers, of the discovery of an important fact in the histology of malignant growths, and the corroboration of this discovery by two other gentlemen in a paper read before the Royal Society on January 21, has stimulated our ever-present interest in this matter, and has opened a hopeful path for further investigation. The two last-mentioned gentlemen, Doctor Bashford and Mr. Murray, have been studying the method of cell division in normal and in proliferating cells, and have embodied their results in the paper mentioned above. These results bear heavily against the hypothesis of the parasitic origin of cancer, and in favor of the view that malignant growths are due to perverted cellular growth and proliferation. These observers have devoted most of their attention to the physiology of nuclear division, which, it is needless to say, is the most important part of the process of cell-division, and is a subject which has attracted a large amount of attention during the past few years. In a few words, this new discovery may be described as follows: observation has shown that, during the process of karyokinesis, the nucleus of a typical cell in ordinary human tissue under normal circumstances divides with the formation of thirty-two chromosomes, one-half of which gather themselves about each nuclear pole, and eventually form the nucleus of the new cell, the body of which is formed by one-half of the protoplasm of the original cell. Certain cells in the body, concerned in the process of reproduction, have been found to show only sixteen chromosomes during nuclear division, and to exhibit a different karyokinetic figure from that seen in ordinary cells. When such cells

meet their physiological complements the normal number of chromosomes for the particular species is restored, and cellular reproduction proceeds in the usual way. Such cells are said to be gametogenic. The English observers have shown that in cancer cells from various sources sixteen is the usual number of chromosomes, and that in other ways cancer cells resemble the gametogenic cells. They have consequently suggested the word "gametoid" to describe such abnormal growth as is seen in the cells of a malignant neoplasm.

The practical indication of this discovery is that under certain forms of irritation or stimulus the normal cells of the body will change their mode of proliferation, will assume characteristics which do not properly belong to them, and in some of their vital processes will approach those of normal gametogenic cells which are known to be extremely active. When a normal cell acquires such qualities it becomes able to proliferate with great rapidity, to invade surrounding tissue with its cellular progeny, and, apparently, to engraft its abnormal powers upon cells in its neighborhood, not its descendants. Such characteristics are those, which, judging them by their results, we call malignant, and this new discovery emphasizes what pathologists have become more and more impressed with, that the study of the most minute and recondite cell processes, is what may sometime lead us to a clear understanding of what malignant neoplastic growth really is, and may perhaps indicate means for the control of such processes.

This discovery does not offer us anything new in therapeutics, but it is an advance in positive knowledge, and as such forms an element in a structure which we may reasonably hope to build to contain

the means for a successful contention with the scourge of malignant disease. It may also prove an efficient means for the differential diagnosis of neoplasms, for according to its testimony the cells of a malignant growth ought to contain sixteen chromosomes and those of a benign tumor, the usual thirty-two, for the human species.

The theory that cancer originates in latent embryonal tissue, suddenly stimulated into activity and perverse growth in some unknown way, does not appear to receive any support from the discovery which we are discussing, and in our opinion further investigations will make this theory still less tenable. There is no reason for assuming the existence of embryonal tissue as the basis of a malignant growth when all the phenomena can more satisfactorily be explained by the theory that malignant characteristics are developed in cells of various normal and properly placed tissues by some so far undiscovered stimulation which causes a perverted and luxuriant proliferation. Malignant degeneration may occur in embryonic tissue, but that is clearly not to be cited as proof that embryonal tissue is the only source of malignant disease. Such occurrences mean simply that the embryonal cells have been subjected to the same form of stimulation or irritation which produces malignant proliferation in the case of other cellular tissue.

By this discovery, additional proof of correctness is afforded to the theory that cancer, both carcinoma and sarcoma, has for its basis a form of perverted cell activity which results in luxuriant proliferation, reversion to an atypical course of growth, and the ability to invade surrounding cellular structures, imposing its characteristics upon them. We believe

that this peculiar form of activity is caused by some form of stimulus or irritation, but of even the approximate character of this we are so far ignorant. We are not referring now to coarse forms of physical irritation exemplified in the causation of epithelioma of the lip, but to some sort of action not improbably brought about by chemical or physiochemical changes in the blood, which is thus unable to supply the cells of the tissue with their normal nutriment. A most hopeful line of investigation seems to be opened by the discovery announced by our English confrères, and we look forward with interest to further developments. The life history of the cancer cell promises to be most rigidly investigated, and it will be the imperfections in our technique and the inherent difficulties of the subject rather than lack of enthusiasm which will make our progress halting and uncertain. A fruitful but exceedingly difficult field for work is in the subject of the metabolism of the cells of neoplasms, and any knowledge gained here might assist us to the important goal for which all are striving—efficient therapeutics.—*Medical Record*.

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#### **A Municipal Tuberculosis Clinic.**

It would be impossible to commend too strongly the clinic for the diagnosing and treatment of pulmonary tuberculosis about to be opened by the Health Department of New York. It will occupy a building on West Fifty-fifth street, immediately adjoining the headquarters of the department, and will include a registration office, two waiting rooms, an x-ray room, a throat department, and two clinics with examination rooms.

It is now admitted that pulmonary tuberculosis is curable and that under

favoring conditions nature will usually effect a cure in incipient cases. The first object of the Board of Health clinic is early recognition and correct diagnosis of cases of consumption. This is often an impossibility for the poor, who can afford only casual medical advice and that not always the most skillful. At the clinic the work will be directed by experts. Not only will careful physical examinations be made, with sputum cultures, but x-ray tests will assist in early and corrected diagnosis.

Patients applying for treatment will not only receive it, but will be given circulars of information in whatever language they can best read, containing exact and intelligible instructions as to precautions necessary to be taken to prevent the infection of others. Sputum cups and proper food for the upbuilding of the system will be supplied without charge to needy patients. Indigent and ambulatory cases and patients discharged from the public institutions of the city will be looked after at their homes and places of occupation by trained nurses constituting a special corps, and the co-operation of charitable organizations has been secured to supply food, fuel, ice, etc., where needed. One of the chief duties of these nurses will be to look after the children in the homes of consumptives and do all that can be done to prevent their infection.—*New York Times*.

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#### X-Rays in Epilepsy.

Dr. J. H. Branth says: As regards Roentgen rays as a remedy in epilepsy, all cases of the disease are not amenable to this treatment, as, for instance, those in which degenerative processes in the brain have set in. In many instances the occurrences of the seizures is believed to de-

pend upon the instability of the cellular brain elements, or an abnormal metabolism, and as it is accepted by many authorities that the x-ray stimulates the vital activity of protoplasm, it was on this theory that the treatment was adopted. For the results obtained, Dr. L. C. Vincent deserved at least half the credit. About a year ago he and Dr. Branth together planned the method, but, owing to severe and prolonged illness, Dr. Vincent was personally unable to take part in the practical work. Three treatments per week are given, beginning with five minutes' exposure at fifteen inches distance, and gradually increasing to ten minutes' exposure and ten inches distance. A hard, or high vacuum, tube is employed, and a different part of the cranium is exposed at each sitting. The hair may drop out in areas, but it is certain to return in a stronger growth than before. In some epileptic patients there seems to exist a bromide drug habit, and to suddenly withdraw the bromides may cause a shock to the system.

In a few instances the best results were secured by returning to small doses of the bromides in addition to the x-ray treatment. With very few exceptions the patients gain in weight at a surprising rate. A lad, fourteen years of age, who was presented by Dr. Branth, had gained nine pounds in four weeks. At the time the treatment was begun, November 8, 1903, the convulsions (grand mal) were becoming more and more frequent and severe, notwithstanding the free use of bromides. Since the date mentioned he had not had a single seizure, and his mother and his teachers had been astonished at his mental, as well as bodily, improvement. In his case the bromides had been at once withdrawn, and in addition



to the x-ray treatment to the head, the static brush had been applied to the spinal region and head. Dr. Branth said he could cite a number of such histories, varying, of course, in different particulars. The gain in weight was noticeable even in those cases in which the mental faculties did not improve so rapidly. In cases of both grand and petit mal it was observed in general that the seizures became lighter and of shorter duration, that the intervals were longer, and that when a seizure occurred it was followed by less prostration than formerly.—*Med. News.*

### Does It Pay To Be A Physician?

An article appearing in *Frank Leslie's Monthly* discusses the status of the physician from a monetary standpoint and asks the question: "Does it pay to be a doctor?" In replying to this the writer makes the statement that the average income of physicians in the United States is \$750 a year, a little more than the day laborer earns working eight hours a day. When we consider that a few are reputed to have an income of \$100,000, a larger number \$50,000, and that quite a respectable body, by dint of close application, takes in from \$10,000 to \$15,000, the average for the remainder must be considerably less than that given. With this alone in view it does not appear that the practice of medicine is a very alluring profession. Then there must be considered the cost of obtaining an education, which can be estimated at from \$2,000 to \$10,000, an investment which has made the fortune of many a business man with far less preliminary training. The arduousness of the work and the long hours bring far less financial recompense proportionately, even under the most favorable conditions, than does any other profession or business, and

from this standpoint also medicine does not pay. For the man who is selfish and sordid who measures recompense by the dollar, medicine does not pay, for it is easy for a man of ordinary ability to financially outclass the doctor. But, for the individual to whom the love and gratefulness of his patients is an inspiration, who can look upon their foibles and follies, and even their petty meannesses, as the naturalist does upon aberrations from the type, who can take joy in his work and joy in the expansion of his knowledge and experience and his increasing capacity for doing good, medicine does pay. To him the seasons bring varied delight. The balmy sun, the glowing verdure, the singing of the birds, the storm clouds, the wind and the pelting rain of the summer are beatitudes. To him the softly falling snow speaks of peace, the dazzling white covering valley and hilltop and weighting the boughs of the trees call to purity and "the dim, mysterious aisles" of the forest, the stillness accentuated by the tapping of a woodpecker or the snapping of a frost-bound tree trunk, are suggestions of solemn grandeur, while to drive these clear, crisp mornings, with the sun shining and the frost sparkling, is an intoxication which quickens all his energies. For one of this kind medicine does pay and to him the profession offers its kindest favors.—*Milwaukee Med. Jour.*

### The Doctor's Income of the Future.—

Doctors who believe—and apparently there are many of them—that the members of their profession are different from and superior to the members of all others, in that they are constantly endeavoring to put an end to the thing out of which they live, really ought to view their

own mental condition with apprehension. The *Times* suggests that they "take something" for it before this queer delusion lets in a lot more and the unhappy victims pass beyond the possibility of help, even from such of their brethren as remain sane. Latest of many manifestations of the belief that the doctors, from a business point of view, are nobly cutting their own throats, is one that appears in the *Post-Graduate*. "It is not generally realized," says that high authority, "that the medical profession is the only one laboring conscientiously and faithfully to destroy its own source of income. Every improvement in hygiene and in sanitary science, every discovery of a specific source of disease, by improving the general health removes large amounts of money from the medical man's pocket and adds incalculably to the wealth of the community. The time will come when this fact will be generally realized." Possibly. But about the same time, there will be a realization, that the labor, conscientious and faithful as it is, and measurably successful as it has been, besides, is not destroying, or even tending to destroy, the source of the doctor's income. For the task imposed upon them is one that, if not quite endless, theoretically, most certainly will not be completed by this generation of doctors or by any generation of their successors in whom they can pretend to have a personal interest. One can conceive, of course, of a time when medical and surgical science shall have made such progress that everybody will live on indefinitely in a state of perfect health, and there will be nothing more for doctors to do, but an enormous "meanwhile" will precede that glorious age, and while it lasts the doctors are in no danger of starving.—*Medical News*.

#### Massage of the Heart for Chloroform Collapse.

W. W. Keen states that on only three occasions in his entire professional life has he had a patient die on the table. The first two were cases of operations on the brain and goitre, respectively. Hemorrhage was the cause of death in both cases, all the usual means being unavailing. The third case was especially interesting for several reasons. This patient had previously had a fracture of the skull from which he had entirely recovered. He later suffered from squamous epithelioma of the vocal cords. At the first operation unilateral laryngectomy was performed, partly under local anesthesia and partly under chloroform. The latter produced marked cyanosis. At the second operation, total laryngectomy was performed. Chloroform and oxygen were given to the patient, but not until he was upon the operating table. When enough chloroform was given to keep him quiet he became so cyanosed as to make the writer very anxious for his life. Just as the wound was ready to be closed his pulse suddenly failed and his face became suddenly blue. The operation and the administration of chloroform were immediately stopped. Strychnin was given hypodermically, pure oxygen was administered, and artificial respiration was instituted with rhythmical traction on the tongue. The battery was applied over the phrenic, but in spite of all this treatment, his heart continued to beat much faster and weaker; he became more cyanotic, and in two or three minutes he was dead. After continuing the above means for about ten minutes as a last resort the upper abdomen was opened and the writer introduced his hand into the abdominal cavity, and between this hand and the right hand, which made counter-pressure on the anterior wall of

the chest, the heart was massaged. These efforts were continued for nearly half an hour, but without avail. The writer then reports a case which came under Igelsrud's care. The operation was that of abdominal hysterectomy. There was chloroform collapse. The writer laid bare the heart by a resection of parts of the fourth and fifth ribs. The pericardium was opened and the heart seized between the thumb and fore and middle fingers on the anterior and posterior surfaces. Strong and rhythmical pressure was made for about one minute when the heart began to pulsate of itself, but as the pulsations became weaker, massage of the heart was practiced for about one minute more. From that time the pulse was perceptible and the contractions of the heart became regular. The patient recovered. The writer gives an interesting *résumé* of work by various authorities on this subject.—*Proceedings of the Philadelphia County Medical Society*, March 31, 1904.

#### Telephonogram.

An apparatus for recording and reproducing sound, as patented by Christian Huismeyer August 2, 1904, differs from the well known Edison phonograph in that the sound is recorded by the effect of light rays upon a sensitive film and is reproduced by passing the film between a source of light and a selenium cell included in a receiver circuit of a telephone. Light from a suitable source is caused to strike upon a mirror and be reflected thru a plate whose transparency varies in the direction of motion of the rays, and to fall upon a uniformly moving sensitive strip. The position of the mirror is determined by the attractive force of an electromagnet in the transmitter circuit of a telephone, so that when sound waves strike the microphone the mirror moves

to and fro and the light which falls upon the film correspondingly varies in intensity, due to the varying transparency of the plate thru which it must pass.—*El. World and Eng.*

#### Chemical Effect of Cathode Rays.

Dr. E. Bose, of Göttingen University, has for two years past made a close investigation of the simplest possible case of a chemical action of cathode rays, with a view to ascertaining whether or not the chemical conversion due to the rays is a purely electro-chemical phenomenon according to Faraday's law (see *Physikalische Zeitschrift*, No. 12, June 15, 1904). A solution of caustic potash, saturated in the hot state, was exposed for a long time to the effect of cathode rays in a convenient outfit allowing of a large electrolyte surface—in fact, about 200 sq. cm. being radiated upon intensely, when a reduction, attended by the formation of hydrogen, was noted. The amount of electricity absorbed by the electrolyte was measured with the aid of a hydrogen voltmeter under reduced pressure, this electricity being drawn off through a platinum electrode sealed into the bottom of the testing tube. As the hydrogen present in the vacuum where the discharges took place was partly dissociated into hydrogen and oxygen, a mixture of hydrogen and oxygen, containing hydrogen in excess, was withdrawn by means of the mercury air pump, and, after the gases due to this dissociation were eliminated, by an explosion, the hydrogen in excess could be measured, and its pure condition confirmed. Now, in the case of the chemical effect of the cathode rays following Faraday's law—i. e., being a purely electro-chemical phenomenon—the amount of hydrogen derived from the vacuum should be strictly the same as the one



evolved in the voltmeter. A high degree of accuracy, it is true, was not to be anticipated, on account of the smallness of the effects and amounts of electricity in question, but the invariable result of the experiments was in opposition to the foregoing hypothesis, 1,030 and even more times the amount obtained in the voltmeter being derived from the vacuum. There must, therefore, be, besides the electro-chemical action, another chemical effect of cathode rays, due obviously to the kinetic energy of the cathode ray particles, this hypothesis being borne out by the theoretical considerations of the author. It is shown that, in the most favorable case, an amount of hydrogen even 1,600 times the electro-chemical amount would be obtained. But it should be remembered that, in most cases, the greater part of the kinetical energy of the rays is simply transformed into heat.—*Knowledge.*

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#### **The Use of Alternating Currents in Chemistry and the Theory of the Reactions Which They Bring About.**

The chemical reactions brought about by means of alternating currents have been studied by M. Daniel, P. A. Berthelot, and some interesting conclusions have been reached. The subject was first taken up by the author in 1897, when he was studying the transformation of sugar into alcohol. The apparatus used consisted of a group of six or eight Bunsen batteries connected to an oscillating commutator, so as to reverse periodically the current thru the electrolyzing cell. This current was passed thru acidulated water, and the regulating resistance adjusted until no gases were liberated at the electrodes. The electrodes were then introduced into the aldehyde, and the effect noted. It was thot that the simultaneous oxidation and reduction might be compared with fer-

mentation, and that alkali would be formed. To understand the action, consider the case of aldehyde in the presence of air and an alkali. Oxygen plays an electronegative role; the aldehyde the electropositive, with a liberation of heat and a change to acid; then perhaps simultaneously the acid acts electronegatively, combining with the electropositive alkali to form a salt, also with the liberation of heat. In this illustration the aldehyde alternates between electropositive and electronegative conditions, and it is such reactions that may be brot about by alternating currents. It will be realized that there are many such.—*Abstracted from L'Eclairage Electrique (Paris), in Electrical Review.*

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#### **A New Use for Windmills.**

Electricity is becoming increasingly useful in farming, and with its growing importance come the various experiments at harnessing the wind and making it drive the generators. Water power, of course, is used where it can be obtained as a prime mover; but where it can not be had, steam has been called in. Steam is expensive, however, and of late experiments with wind driven generators have become numerous.

Windmills are as common in many parts of the central West as in Holland, but hitherto have been used only for purposes of irrigation. Recently, however, they have been used to generate electricity—at first for lighting houses and barns, but now for running motors used in driving light machinery. At two experimental farms in Germany two complete electrical plants are in operation, deriving their power solely from the wind, and in this country windmills are in practical use, connected with generators or with pumps, as the need of the hour demands.

On some farms several mills are coupled in operating the generators, and ten-horse power motors are worked continually. On other farms the windmills and the motors are distributed, producing lower power at various points rather than high power at a single point. Even a single large home-made windmill may generate enough power to run a two or three-horsepower motor, so that the use of electricity is not confined to those able to buy especially made windmills. For the small farmer, therefore, the possibilities of wind-driven electrical generators are very great.—*Ex.*

#### The Earth Currents.

M. Guarini recently gave a very interesting lecture to the *Société Belge d'Astronomie*; this lecture was on the much discussed subject of earth currents—that is to say, those currents which go thru the earth, but which are generally produced by some outward cause. M. Guarini says that all the theories put forward to explain the earth currents, such as the influence of the wind, aurora borealis, rain, storms, electro-chemical effects, etc., none of them accounts for an incontestable fact; for there is in the earth an earth current, whose direction is carefully marked out, going from northwest to southeast. Now a constant effect can not be due to variable causes, at any rate as variable and intermittent as those referred to above; wind, storm, etc. According to M. Guarini, the atmospheric agitations produce some of them by friction (the wind), others by induction (hail, rain, snow, etc.), certain variations of potential at certain places in the ground. These are the fluctuations of the potential, says M. Guarini, which produce at certain moments sudden variations in the intensity, and even in the direction of the earth currents.

According to M. Guarini, the earth current can only be due to a cosmic effect; that is to say, due to the rotation of the earth (the armature) round the sun (the field). By the rotation of the earth there would be induced into the atmosphere a current going in an inverse direction from that of the rotation as in dynamos; this variable current induced into the atmosphere induces in its turn in the earth's crust an inverse current; that is to say, moving in the same direction as the rotation of the earth. Now theory and observations agree with the idea put forward by M. Guarini. Siemens and Geitel have proved that the sun induces a vitreous charge into exposed objects. On the other hand, from Palmieri's observations it appears that the earth current is a current induced by the atmosphere. Lastly—and this is the most interesting fact—experience proves, as M. Guarini says, that the earth turns from west to east; that is to say, that the rotatory movement of the earth takes the same direction as that of the continuous earth currents. M. Guarini believes that it is possible, as Ampere always insisted, that it is the earth current which makes the magnetic needle deviate. M. Guarini points out that in that particular also facts and theory coincide, and he proposed an experiment to prove this.

After having spoken of the influences of tramways and transmissions with the earth as a means of return on observatories, he refers to his trials and those of the *Compagnie de l'Industrie Electrique et Anecanique de Geneve*, for the purpose of suppressing them completely. Lastly, the earth currents are very useful in agriculture because they decompose the chemical products which are in the earth, and replace them by others more assimilable for the plants.—*Elec. Rev.*

## The Inventor's Meed

BY "INNOCENS."

A certain Man worked for a Firm. And as he worked an Idea came unto him. And not being used to such things he laid down his tools that he might think it over.

But the Foreman, perceiving this, straightway came for him and asked him in chromatic and elliptic language wherefore he labored not. Then said the Man unto him, "Verily, I have an Idea!"

And the Foreman answered him, "Thou unprofitable laborer! By what right and by what authority dost thou have an Idea in thine employer's time? Labor thou with thine hands, and sweat thou with thy brow! For I, even I, will do all the thinking that is necessary in this shop!" This said he for that he was wroth; for he never had an Idea.

And the Man answered him, "Nay, but this is an Idea whereby the arc-lamp mechanism whereon I labor may be greatly improved. The cost of production will be diminished, and simplicity thereof will be such as thou hast not imagined in thy dreams." And taking in his hand a piece of chalk he drew diagrams upon the bench.

The Foreman therefore looked on with a haughty expression, and when the Man had finished he turned and rent him for wasting his time.

Nevertheless, at the sixth hour, he cometh privily unto the Works Manager, saying, "Lo! I have somewhat to impart unto thee!" And the Manager answered, "Say on!"

And he said, "It came to pass that, as I was walking my shop, and bossing my men, an Idea came unto me, whereby thou mayest effect great economies in the

production of thine arc-lamp mechanism."

And the Works Manager was astonished at the saying, for he deemed the Foreman incapable of invention. Nevertheless, he was very gracious unto him, saying, "Speak thou all that is in thy mind!"

Thereupon the Foreman attempted to reproduce the diagrams that the Man had shown unto him. And not having understood them, he got into an hopeless mess. Then said he, "Verily, when I had the Idea, I incautiously mentioned it to the Man that worketh upon these mechanisms, and he hath made foolish suggestions that have muddled me!"

The Works Manager, therefore, having passed two-score and ten years in a sinful world, saw unto the truth of the matter, and smiled, saying, "To-morrow, at the ninth hour, bring hither that workman with thee unto me. Peradventure he will, by repeating his foolish suggestions, clear thy mind for the Idea that is thine."

And as the Foreman departed he cursed three curses—one for the smartness of the Works Manager, one for the Idea of the Man, and one for his own stupidity.

The Man therefore explained his Idea unto the Manager and the Manager saw that it was good. He said therefore unto the Man, "Leave thy bench, and go into our Experimental Department and labor thou there. Our specialist shall assist thee until thou hast perfected thine Idea. Then come thou again unto me, and the Firm shall recompense thee."

After many days the Man returned, saying, "Lo, here is the mechanism which I conceived, and it worketh beautifully. What, therefore, wilt thou give me for mine Idea?"



And the Manager replied, "Tarry a little, till we get the lamps upon the market and make a profit thereby. Then shalt thou have thy reward."

So the Manager straightway patented the Idea in the name of the Firm, and it was put upon the market. And the firm profited thereby to the extent of four hundred and thirty pieces of gold in the first year, for the lamp was very good.

The Man, therefore, came again unto the manager, saying, "Where is the reward thou promisedst me? For I have seen the balance-sheet of the Firm, and lo! the profit is very great."

And the Manager smiled benignantly, and handed him a fiver, saying, "Take thou thy reward, for we believe in encouraging our employes to take an interest in their work." And he was pained at the attitude adopted by the Man, and ordered him out of his office.

The Man therefore consulted a Lawyer who lived on Small Fry. And he, having induced the Man to sign divers documents whose purport was unintelligible, wrote a threatening letter to the Firm.

The Manager therefore kicked the Man out of employment and instructed the Firm's solicitors.

And when the case came for trial it was definitely proved that the Man was an artisan employed in the Experimental Department, and that the Specialist had had the Idea.

The Lawyer who lived upon Small Fry therefore came upon the Man for his costs; for this is apparently what the documents were about.

The Man therefore, he and his family, went into the Workhouse.

MORAL.—Whom the Gods wish to destroy, they first make inventive.—*Electrical Review*.

**The Sounding and Radiography of the Large Intestine.**—Schule (*Archiv fuer Verdauungo-Krankberton*, Vol. x, Part 2.)—For many years investigators have been endeavoring to solve the problem of sounding the colon; during the past few months the agitation of this subject has received a new impetus. As early as 1862 Wachsmuth maintained that under favorable circumstances it is possible to pass a tube, 166-196 cm., long as far as the valve of Bauhin.

Simon carried out a series of investigations on the cadaver a few years later and came to entirely different conclusions. He found that it was sometimes possible to pass the tube into the descending colon, but no further. As a rule the sigmoid flexure formed a figure eight through the pressure exerted, and the tube did not pass beyond the sigmoid.

Leichtenstern, Vaunyn, Boas and Kuhn have come to the same conclusion.

The latter found that the tube was usually halted on its course in the sigmoid and that this portion of the intestine was pushed upward, thus giving the impression that the tube was passing into the colon.

He believes that through combined manipulation and the careful use of the spiral tube, it is possible to prevent this curving of the sigmoid, and to introduce the tube further into the colon.

The author, who carried out an extended series of investigations, claims that it is not possible to introduce a tube into the colon with any degree of certainty, and he doubts if the living being has ever been catheterized successfully, at any rate there has been no proof of it.

He made a series of radiographs, both from the living and the dead, showing the course and position of the tube in

the sigmoid. Very often when the tube seemed to have passed nicely it was completely rolled up in the sigmoid. In some of his experiments the peritoneum was opened and the course of the tube was watched and even controlled. Even in these cases it was almost impossible to pass it into the colon. The series of radiographs presented in this article are very instructive.

The colon tube can not be used for diagnostic purposes where tumors and stenoses are suspected, for it would be impossible to determine whether the tube was meeting with one of the natural obstructions and obstacles in the sigmoid or an abnormal condition.

As to the therapeutic value of such a procedure, the author believes that practically the same end can be accomplished through rectal enemata properly applied. Mosler showed that the fluid introduced into the rectum came out through a fistula in the cecum. He also demonstrated areas of absolute dullness in the cecal region after the injection of large amounts (three to four litres) of water into the rectum.

Boas maintains that the succussion sound obtainable in the cecal region after rectal injections shows the presence of liquid in that region.

The author demonstrates very clearly thru his radiographs that fluid injected into the rectum may reach the cecum. He injects 300 to 400 cm. of oil containing a considerable quantity of bismuth in suspension into the rectum of a patient in the knee-elbow position. The radiographs of these cases give such definite outlines of the colon that there can be no doubt as to the course taken by the oil mixture. In all of these cases the ilio-cecal valve proved sufficient, so that no

shadow was obtained beyond this point. These pictures not only prove that it is possible to "wash out" the colon thru the simple rectal enemata, but also show the position of the transverse colon. In one of these cases enteroptosis is beautifully demonstrated. The method will certainly prove of great value in the determination of the topography of the colon in the living.—*Interstate Med. Jour.*

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### Self-Reliance.

Remember that all the good you accomplish is going to come out of yourself. You can not borrow it and you can not make it out of that which has been poured into you by education or otherwise. All that you receive is only a certain quantity of knowledge, acquired by education, experience, or other training, which will have a certain influence upon what comes out of yourself as your own. It is the inherent capacity to perform with your own brain which will make you what you become, and not the mere transmission of that which you have acquired. Your knowledge, therefore, is of little avail until you make it inherently a part of yourself thru mental assimilation and utilization. The clearer you comprehend these things, the more readily you can make use of them as against the process of mere acquirement with a vague motive that in some way or other what you acquire may be of benefit, or that environment will be the force that makes your talent effective. Some have gone thru experience without acquiring it, and many a man who has received an education has not got any because he allowed it to be a thing apart from his personality and it slipped away.—*Walter C. Kerr in Electrical Review.*

#### American Electro-Medical Society.

The executive council will admit to the program of the next meeting (December 1 and 2) papers on any branch of progressive therapeutics. Papers are expected from Dr. O. Shepard Barnum, Dr. Heber Roberts, Dr. Ivan E. Amilon, Dr. Carl Beck, Dr. J. A. Robinson, Dr. H. Preston Pratt, Dr. J. A. Robinson, Dr. John E. Gilman, Dr. Stuart Johnstone, Dr. James R. Hawley, Dr. H. L. Lewis, Dr. Sheldon Leavitt, Dr. D. A. Stevens, Dr. H. Perkins Fitzpatrick, Dr. F. A. Lensman, and several others.

The meetings will be held in the Masonic Temple, Chicago, commencing at 10 a. m. on Thursday, December 1st. This is a convenient time for those who are on their way eastward from the World's Fair formal closing.

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#### Dr. Niels R. Finsen.

Dr. Finsen died September 24th at Copenhagen, at the early age of nearly 44, from a complication of disorders of the heart and digestive organs of long standing, which were intensified by his neglect of his own health in his enthusiastic pursuit of his investigations for the benefit of humanity.

He was the son of a poor fisherman of Faroe Island and had to work for his livelihood and his education. His health was always defective. Born in 1860, he obtained his early education in Iceland, and later studied medicine in Copenhagen and completed his university course there in 1890, obtaining the degree of M. D. at the head of his class.

While a student he became interested in the therapeutic value of light, and after graduation devoted all his energies to this investigation. His confreres thought him a crank, of course, but neither poverty nor ill health nor the indifference

and contempt of others could deter him from his aim. In July, 1903, he published a paper on "The Influence of Light on the Skin," which excited great interest because of his claim that smallpox could be cured, or at least greatly moderated, by the exclusion of all but red light from the sickroom. In the following year this treatment became quite popular and Finsen's reputation was established.

Experiments were soon made upon cases of lupus, and some of these were cured by concentrated sunlight or electric light when every other known means had failed. This excited universal interest and secured for Finsen both moral and financial support in the prosecution of his experiments.

In 1896 the municipal hospital of Copenhagen gave him the use of some small buildings to continue his work. Later the Danish government came to his aid, and his enlarged institute was removed to Rosenvaenget, a suburb of Copenhagen. Here his work has been since carried on successfully in the cure of lupus and similar "incurable" diseases of the skin.

The Norwegian parliament, in December, 1903, awarded Dr. Finsen the Nobel prize of \$40,000 for the most notable discovery in medical science. It was with difficulty that his friends were able to persuade him to devote even a part of this money to himself and his family. His complete forgetfulness of self, together with his chronic diseases, had prepared his family and friends for his departure after a short but extremely valuable life.

Institutes for carrying on Finsen's work have been established in nearly every civilized country. One of these—the Finsen Light Institute of America—is in Chicago. Short as was his life, he had



the pleasure of seeing his work recognized and appreciated by the world at large. This prompt recognition was due not only to the highly scientific character of his investigations, but to his full recognition of the share contributed by other investigators to his results, and to his own modesty. His salary from the Danish government was only \$1,200 a year.

His funeral, September 29, was attended by the King of Denmark and the King of Greece, and nearly all the other European rulers sent personal representatives to pay their tribute to his greatness. Among scientists, ministers of state and princes were also many humbler men and women who owed to Finsen relief from pain and otherwise incurable disease.

Whatever time may finally decide as to the relative value of light, the x-ray and other means of treatments for lupus vulgaris and cancers, the fact remains that to Finsen is largely due the strong impulse now manifested toward the cure of disease by means of light. His work lives.

**Origin of Radium**—Sir William Ramsay in a recent lecture on radium referred to the fact that not only is the proportion of radium to uranium in rocks wherever found apparently the same, thus pointing to the uranium origin of radium, but also that the amount of helium in the composition of rocks possibly affords an internal record of the rock. It is too early to offer a reliable assertion as to the origin of radium, yet there is reason for believing that uranium is its parent and predecessor. Possibly, therefore, uranium is an unstable element and slowly degenerates atom by atom into radium, the time of half loss being, say, a billion years. Radium again degenerates into helium and other products, which in

turn go through relatively shorter periods of degeneration into more stable but relatively de-energized forms of matter. It was pointed out that the evidence was strong in favor of the belief that the energy liberated by radium and its emanations was internal energy of degradation and not energy reflected from without.—*El. World and Eng.*

---

#### A New Ray.

M. di Brazza claims to have discovered a new sort of ray which he calls the i-rays. The brain gives rise to these as well as the N-rays, but the i-rays differ from the N-rays in that they pass thru moist substances.

---

#### A New Fuel.

By the aid of an electrical process a new fuel "osmon" has been produced from peat. A direct current is passed thru the mass by which twenty or twenty-five per cent of the water is eliminated. The electrically treated peat is then dried and crushed and made up into briquettes. It possesses quite a satisfactory heating power, contains no sulphur and does not smoke or leave much residue.—*Electrical Review.*

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H. L. SAYEN  
Inventor of the Queen X-Ray Tube



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Devoted to Practical X-Ray Work and Allied Arts and Sciences.

VOL. XV.

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## Report on N-Rays.\*

BY ANDRE BROCA.

### PHYSICAL PROPERTIES.

These rays traverse for the most part bodies opaque to light; aluminum, paper, pasteboard, wood. But certain substances are opaque: these are pure water, which is opaque at a very slight depth; lead, which is opaque if 0.2 mm. in thickness; platinum, when 0.4 mm. in thickness. Glass is quite opaque, altho considerably less so than the preceding bodies. A very curious fact is that salt water permits them to pass, altho pure water is opaque.

The n-rays are stored up in the bodies which they strike in certain cases. Quartz, Iceland spar, glass, brick, sulfid of calcium, lead and salt water possess this property; wood, paper, aluminum, do not possess this property. When the action of the source ceases, the bodies thus exposed emit n-rays for a longer or shorter time.

This fact is quite analogous to the phosphorescence of certain bodies under the action of sunlight. Bichat has shown a very close similarity in the details of these phenomena.

It is a fact that a body which stores up n-rays when heated will quickly lose this property on the temperature becoming lower. At the same time, if analyzed by

means of a prism, after the method of Blondlot, which we have described elsewhere, the radiations emitted by a body which has stored up n-rays always gives radiations much greater in wave length, than the radiations which have not been stored. The expression "store up," used to designate this phenomenon, is not the most appropriate, for it refers to a transformation in the secondary rays analogous to that which light undergoes in phosphorescence or fluorescence, analogous also to that which the x-rays undergo at the surface of bodies which they strike. We retain, however, the expression "store up," employed by Blondlot to designate the phenomenon, and which has the advantage that it enables one to thoroly grasp the existence of the relatively considerable delay which is frequently observed in the perception of n-rays.

Bodies opaque to n-rays, like lead, store them up to a greater depth the longer they have been exposed. Frequently the delay of the discharge is very prominent in observation of n-rays. For the purpose of reducing this to a minimum one ought to use as a phosphorescent screen a layer of sulfid of calcium as thin as possible; for the sulfid displays with great intensity the phenomenon of storing up. It also is necessary to keep in mind this fact of

\*Translated from Archives d'Electricité Médicale by J. Z. S. Haywood, D.-es-Sc., continued from page 296.

storing up when studying n-rays, else the observations would frequently be vitiated thru the use of screens which store up the rays. Screens of lead would occasionally give room for the gravest mistakes, for they themselves would be the sources either of n-rays, or  $n_1$ -rays. I myself have seen screens of lead which normally emitted at their surfaces n-rays from certain points and  $n_1$ -rays from other points.

The n-rays enjoy the property of self-reflection and self-refraction. When one takes a prism of aluminum and lets fall upon it a bundle of rays limited by two parallel plates of lead situated a certain distance apart, a considerable dispersion is observed in the emerging bundle of rays, manifested by the existence of sufficiently clear bands. Blondlot has been able to measure the mean indices, and he has found likewise, in the emission of a Nernst lamp, studied by means of an aluminum prism of 30 degrees and a screen of sulfid, the existence of eight distinct radiations. With a prism of 90 degrees he has been able to separate the least refrangible radiations. These include eleven radiations which pass thru aluminum. Afterward he was able, by employing ordinary grating, to measure the wave length of the radiations thus isolated.

A remarkable fact noted, which would not be marvelous in another place, is that the n-rays have much greater refraction indices when their wave length, measured with the screen (grating), are the greatest. It should be remarked that aluminum gives, for these radiations, an anomalous dispersion. This is not extraordinary, because this metal absorbs considerable of the luminous and ultra-violet radiations, and the anomalous dispersion is correlative with the absorption of the parts of the spectrum near those shown.

All these facts are summed up in the following table:

| Length of Undulation in Bicarons (thousandth of a Micron.) | Refractive Index for Aluminum. | Nature of the Rays. |
|------------------------------------------------------------|--------------------------------|---------------------|
| 3                                                          | 1.004                          | $n_1$               |
| 4.8                                                        | 1.0064                         | n                   |
| 5.6                                                        | 1.0096                         | $n_1$               |
| 6.7                                                        | 1.011                          | n                   |
| 7.4                                                        | 1.012                          | $n_1$               |
| 8.15                                                       | 1.04                           | n                   |
| 8.3                                                        | 1.029                          | n                   |
| 9.9                                                        | 1.19                           | n                   |
| 11.7                                                       | 1.4                            | n                   |
| 14.6                                                       | 1.68                           | n                   |
| 17.6                                                       | 1.85                           | n                   |

The other rays separated by a prism of aluminum have not yet had the length of their undulations measured, they are those whose indices are 1.48, 1.36 and 1.29.

With a prism of 30 degrees the radiations observed are the last six of the above table (of which 1.04 and 1.029 are not separated) and the three aforesaid. A prism of 90 degrees is necessary to separate the first seven in the above table.

Jean Becquerel has been able to show, in the lengths of undulations thus measured, the existence of two series wholly analogous to those observed in the emission of incandescent vapors. The lengths of undulation in millionths of a millimeter are, one set approximately

| Multiples of 2.9 by | Length measured. Bicarons. | Length calculated. Bicarons. |
|---------------------|----------------------------|------------------------------|
| 1                   | 3                          | 2.9                          |
| 2                   | 5.6                        | 5.8                          |
| 3                   | 8.3                        | 8.7                          |
| 4                   | 11.7                       | 11.6                         |
| 5                   | 14.6                       | 14.5                         |
| 6                   | 17.6                       | 17.4                         |

And others which are approximately

| Multiples<br>of 4.9 by | Length<br>measured.<br>Microns. | Length<br>calculated.<br>Microns. |
|------------------------|---------------------------------|-----------------------------------|
| 1                      | 4.8                             | 4.9                               |
| $\frac{4}{3}$          | 4.8                             | 6.5                               |
| $\frac{3}{2}$          | 7.4                             | 7.35                              |
| $\frac{5}{3}$          | 8.15                            | 8.16                              |
| 2                      | 9.9                             | 9.8                               |

Are these bands due to the emission of the lamp, itself discontinuous, or to a selective absorption of aluminum, or to a selective action of the n-rays upon sulfid? We have yet to learn.

At the same time that the n-rays are dispersed by a prism of aluminum the existence of other rays is shown, which, in place of increasing the brightness of the sulfid or that of the spark, on the contrary, diminish it; these are the rays which Blondlot named  $n_1$ . We have already spoken of them several times above.

Jean Becquerel has shown that when a body emits in a certain direction the n-rays, it emits in the normal direction the  $n_1$ -rays. This is the case with a body properly isolated, Rupert's drops, or a stretched wire. Thus, when one observes the action of a Rupert's drop the latter is seen to emit n-rays normally at its lateral surface and  $n_1$ -rays in the direction of its length. This fact is observed likewise at the point where the drop begins to swell. The laws relative to both n and  $n_1$ -rays are the same in other respects.

In certain properties the n rays resemble rays of light; the velocity of propagation, reflection, refraction and polarization. In others, and "storing up" is the principal of these, it differs completely.

Bagard has shown that the magnetic field produces, when acting on polarized n-rays, rotation of the plane of polarization and that rotary active substances act upon them the same as upon light.

But we have now to touch on a series of properties which distinguish n-rays from light. First of all we have the property pointed out by Charpentier for certain n-rays of being conducted thru metals. A metallic wire ever so long produces but a feeble diminution of their intensity. Bichat has shown that in the metals the propagation occurs as in a luminous fountain. The wire permits the n-rays to escape when it is oxidized on its longest part or when it presents a bend at an acute angle. Charpentier at the same time pointed out that when a metallic screen is placed in the path of the n-rays and grounded by a metallic wire the flow will be entirely arrested. Here are two properties which already seem to differentiate completely the n-rays from light. But all the n-rays do not serve equally for these experiments.

Jean Becquerel has shown that all the n or  $n_1$ -rays have another property which distinguishes them completely from light and allies them more closely with the kathode rays; it is that they are modified by the magnetic field. A pencil of n-rays in a magnetic field is decomposed into a series of pencils which revolve in the magnetic field, following circumferences of different radii of curvature. One ought to say that in all probability these radiations are due to rays analogous to the beta-rays of radium, for the form of deviation is precisely that given by the beta-rays (kathode streams).

When one searches with a phosphorescent screen at a distance of ten to fifteen centimeters from the point of entrance of the rays in the magnetic field, and uses a small screen mounted on a handle, he sees that he has also, very near the point of entry, some of the  $n_1$ -rays, deviated in a way inverse to that of the n-rays, but



which are rapidly absorbed by the air. They have, therefore, the same properties as the alpha-rays (streams of positively charged particles) of radioactive bodies. But a deeper study shows that there are not so many of the  $n$  and  $n_1$ -rays after traversing the magnetic field, that they are, for the most part, and probably solely, beta and alpha-rays. In short, we know that above all the beta-rays excite phosphorescence and that the alpha-rays diminish it. The first behaves like the  $n$ -rays, the second like the  $n_1$ -rays. The fact of the considerable absorption of the  $n_1$ -rays, due to the action of the magnetic field, while, normally, they are spread in the air without sensible absorption, shows that by the action of the magnetic field the  $n_1$ -rays are profoundly modified. This considerable absorption increases their resemblance to the beta-rays.

When one studies exactly with a phosphorescent screen the prolongation of the incident pencil he perceives that where the magnetic field exists he has nothing, or next to nothing, in that direction.

It can not be said that no radiations are propagated in this direction; on the contrary, if beta-ions are joined to it, an  $n$ -ray deviates; if alpha-ions are joined to it an  $n_1$ -ray deviates. Jean Becquerel accomplished the first by placing in the path of a non-deviating radiation a small piece of radium; he accomplished the second by replacing the radium by polonium.

Moreover, this ray which is not deviated by the magnetic field is susceptible of being reconstructed from  $n$  or  $n_1$ -rays by the addition of suitable ions susceptible of dispersion. It suffices, to convince oneself, to let it fall upon an aluminum prism. If, afterward, this prism is replaced by radium, one observes a whole series of  $n$  radiations dispersed, as in the experiment of Blondlot, and if polonium be sub-

stituted for radium one will see  $n$  radiations transformed into  $n_1$  radiations.

According to Jean Becquerel an  $n$ -ray is formed by an electro-magnetic radiation analogous to light, of a very short wave length, which carries with it negative ions; an  $n_1$ -ray is composed of the same radiations bearing positive ions.

This explanation of the physical properties of the  $n$ -rays will be brot to an end by reference to a paradoxical property possessed by the sources of  $n$ -rays when subjected to the action of chloroform. When the vapors of this anesthetic reach a source of  $n$ -rays, such as isolated quartz or isolated sulfid of calcium, the  $n$ -rays emitted by the source employed will be seen to diminish, then die out.

#### THE PHYSIOLOGICAL ACTION OF N-RAYS.

Heretofore we have described only those actions of the  $n$ -rays which really enable us to observe them. When the  $n$ -rays act upon a source of light somewhat intense they augment the brightness; the  $n_1$ -rays, on the contrary, diminish it. Blondlot has observed the fact, as has already been mentioned, on plates of platinum rendered incandescent by an electric current, and upon sheets of paper suitably illuminated.

The experiment is made as follows: Gaze at the surface of white paper bearing a large black streak, or, better, a clock face on a wall somewhat darker than the latter. Then lower the curtains of the room so that the hands of the clock are just visible. Then turn on the source of the  $n$ -rays and the hands of the clock or the black streaks will reappear. On repeating this experiment a little differently Blondlot found that the action is produced equally when, in place of causing the sources of the  $n$ -rays to act upon the illuminated surface, they are made to act upon the eye itself. It is clearly seen that

it is the modification of the n-rays emitted by the slightly illuminated surface which produces the modification of the apparent brightness. Jean Becquerel has proved this fact by watching the phosphorescent sulfid traverse a screen of distilled water, opaque to the n-rays. He has been able to ascertain, in this case, that the variations of brightness of the sulfid were, if not wholly suppressed, at least diminished in a considerable degree. This demonstrates the fact previously stated or, at least, it shows that it includes the greater part of the phenomenon.

The n-rays do not act directly upon our retina to produce the sensation of light, but they act so as to modify the excitability of our retina for the light. Besides, as Jean Becquerel has found, when a body is struck by the n-rays it throws off from itself n-rays at right angles to its surface and  $n_1$ -rays tangentially; the reverse effect is produced when it is struck by  $n_1$ -rays.

The sensibility of the eye is especially modified by the blue (Gutton) whenever the n-rays are active; the physiological nature of their action explains the failure to discover the n-rays by photography of the surface of the phosphorescent sulfid. In consequence, if we are able to augment the brightness of the surface of the sulfid observed normally, it is not because its luminous emissions are modified, but because its n emission is augmented. The latter do not act upon the plate, but solely upon the eye.

But there are some procedures which do reveal the n-rays objectively; we have already seen one, a photograph of the spark, made by Blondlot himself. There is still another, that of Rothé. When a spot of isolated sulfid is placed a little distance, for example 5 mm. from a photographic

plate, we see on the latter a light and soft impression. The diameter of this impression is seen with great exactness. The diameter will be found larger in proportion to the brightness of the sulfid. On repeating this operation every twenty seconds, giving an exposure of five seconds, we obtain spots of diminishing diameters, and these diameters, by their decrease, give an idea of the decrease in brightness of the sulfid. When there is no activity of the n-rays, there is found a regular diminution in diameter of the impression of the spots.

In this operation, let the n-rays act for thirty seconds, take an impression, then leave the sulfid to itself for thirty seconds, then take another impression. Repeat these operations several times in alternation. The form of the curves will be found to be deeply modified. The velocity of the action of the n-rays diminishes in proportion as the phosphorescence decreases.

These experiments of Rothé show that in addition to the influence exerted upon the n-rays emitted by the sulfid, there is another action, that upon the true luminous emissions, disclosed by photography, as has been proven by Jean Becquerel. Ordinary photometry ought to show this action, too. It seems to be limited to the first two or three minutes of the experiment.

It is, therefore, proper to say that the greater part of the phenomena set in play by n-rays are physiological phenomena. This study will be continued by noticing their action on organs other than the eye.

Above all, they act directly on the central nervous system. Blondlot's experiment on vision with the clock-face will succeed equally well, as has been shown by Charpentier, if, in place of causing

n-rays to act upon the eye, they are made to act directly upon the center of vision of the occipital circumvolutions.

In these circumstances, Charpentier has proved a pupillary dilation thru the action of n-rays. This action alone is sufficient to explain the augmentation in luminosity and to explain why the latter is not always well seen, which is a notable feat when dealing with such a feeble, ambient light.

Charpentier has shown another action of the n-rays, that on the olfactory nerve. The acuity of the latter is increased by n-rays in a like manner as vision.

In short, he has shown that the n-rays were conducted along the nerves, or, at least, excited along them a very noticeable effect. On applying a source of n-rays to a collateral nerve, of a finger for example, there will be perceived, by means of a phosphorescent screen, an augmentation of brightness over the cerebral center corresponding to the motility of the finger impressed. No direct action is perceived, but the emission of the n-rays by the corresponding nerve center is deeply modified.

The inferior organisms are equally sensitive to the n-rays. It is by means of these that Richet has shown that in lactic fermentation there is first an acceleration of action followed by a diminution of the rays emitted by the phosphorescent sulfid.

Lambert and Meyers have discovered a retarding influence of the n-rays on the germination of garden-ress and likewise on the digestion of fecula by the saliva.

It appears that the n-rays ought to have considerable influence on the phenomena of life; their presence in great abundance in solar light and their absorption by water furnishes a clear explanation of the facts relative to climate and to mountains.

#### THE PHYSIOLOGICAL RAYS OF CHARPENTIER AND THEIR APPLICATION.

We have already alluded to the existence of these radiations—we will now point out their principal properties. First of all, when a phosphorescent screen is brot near to the body, either of an animal or plant, the luminosity of the sulfid is augmented. It is soon perceived that the luminosity varies, following the points of the surface of the animal under examinations. At first sight the luminosity is seen to be augmented to the maximum when the screen is contiguous to the nerve centers of the brain or medulla. In order to go farther off it is necessary to employ a "récepteur à localisation," formed of a lead tube with an interior diameter of about 5 mm., opaque to the n-rays, provided with a phosphorescent screen at one end. In these circumstances, if the free extremity of the tube be applied opposite the source of the n-rays under examination, the screen will be impressed by that part of the source which is found immediately below the opening; the parts situated without emit rays which are absorbed by the lead and hence do not reach the sulfid. It is thus possible to study the localization of the centers of emission of the n-rays. Certainly, the lead should, as we have seen, store up the n-rays, but this is a tardy phenomenon which does not mask the more rapid phenomena which we are now going to study.

When, under these conditions, the free end of the tube is placed upon any part of the body, it is easy to outline the paths of the nerves, which emit a greater number of n-rays than do the neighboring tissues. Likewise, the muscles in contracting emit more than the same muscles in repose. The latter rays are able to pass thru lead in a slight degree, and also thru pure water; unlike the radiations from



the brain, which, according to Charpentier, are slightly arrested by aluminum.

Thus it is easy to outline the area of the heart, to see the workings of the various cerebral centers, especially the center of articulate speech. It is also possible, by placing the localizing tube upon the cranium and along the spinal cord, to see, while the individual submitting to the experiment is reclining and the muscles relaxed as much as possible, remarkable variations in brightness. These correspond, on the skull, to the cerebral fissures; along the vertebral column, to the centers of activity in the medulla. Above all, the ilio-spinal center and the genital center may be distinguished clearly.

During normal sleep the phenomena are not sensibly changed. During anesthesia, on the contrary, at the moment of profound narcosis the brain is seen to emit  $n_1$ -rays instead of n-rays. When this phenomenon appears on the spinal cord the animal is in danger of death; it then is necessary to resort immediately to artificial respiration. After death the passage of the n-rays ceases almost immediately in the warm blooded animals. According to Charpentier, they were observed, however, for several months in a desiccated frog. Perhaps the phenomena in this last case is very complex and bound up with the action of microbes.

The same writer has been able, by means of the n-rays, to study the results along an excited nerve, and he has been able to show that lengthwise of the nerve there is propagated an undulation having a wave length of 16 mm.

What seems the most curious fact in this domain of curiosities is the fact announced by Charpentier of the affinity of the n-rays emitted by the various organs and these alkaloids which have a specific action on the latter.

If a sulfid screen be placed on a box containing strychnine, for example, it is the spinal cord which gives the maximum brightness. If chloral be used, it is the brain which acts the strongest; if the box contains digitalin the heart will be found to produce the greatest action. It seems then that the alkaloids which act upon an organ are themselves capable of emitting n-rays, especially powerful under the influence of n-rays emitted by the organs themselves. This should be an indication of the greatest importance on the relations which ought to exist between the organs and their poisons.

#### DULL EMISSIONS.

The attention needs to be directed to certain other phenomena. Blondlot has shown still other facts which seem to be the generalization of the radioactivity of matter. He has shown that when the field about a piece of money is explored, by means of a screen of sulfid, certain well determined regions are found where the brightness is augmented. The whole phenomenon appeared as if the piece of money threw out electrical emissions, following in the air a trajectory slightly parabolic at its origin, and tending at the limit to become a vertical line.

Berthelot's idea seems to be that these emanations are due to a number of infinitesimal reactions which are produced constantly at the surface of bodies and which occur between the bodies and emanations of all kinds from living beings. These incessant reactions are visible to the eye all the time when a metallic surface is scraped. Likewise, in the case of gold, the surface is seen to lose rapidly a portion of its brightness. Platinum should be chosen, in order to have something lasting relatively to the phenomena of contact, and then cleaned with rouge.

These ideas have been verified for the

most part by the experiments of Blondlot himself. On repeating with pure metals the experiments at first made with pieces of money, he saw that all the metals, excepting lead, gave a dull emission when their surfaces are slightly oxidized and soiled; they do not give them when chemically pure and clean. Lead gives just the reverse of the above phenomena. The liquids and the crystals are the most active. The following are inactive: Iridium, platinum, gold, dry glass, melted sulfur, gypsum, chalk. The dull emanations of these different bodies are formed of three forked handles. One of these branches is positively charged, the second negatively, the third is not charged. They are divided into these three groups either by the magnetic field or by the electric field.

To make this experiment it suffices to place a thin line of phosphorescent sulfid of calcium on a table and to place at its side a piece of money on a plate. If the latter is placed hard by there is no action. If it be moved a few centimeters there will be seen, in a certain position, an augmentation of the brightness of the sulfid. It will change to its original value if you continue to move the piece of money. At the moment of maximum brightness

the spot of sulfid will meet, at the intersection of the table, the parabolic trajectory of the ray issuing from the piece of money. These trajectories rise about 6 cm. above the piece which emits them and traverse a considerable number of solid bodies.

Julien Meyer has pointed out that analogous emanations, but of much greater velocity, appear to be emitted by the human body. A priori, one should know positively if the rays which we have studied as the rays of Charpentier are formed by n-rays or by the dull emanations. It is known that a part of the phenomenon is due to n-rays.

Charpentier has shown experimentally that his rays can be concentrated by lenses of quartz and aluminum. But those which we studied by placing the screen upon an organic body were something very complex, including n-rays and the three species of dull rays. The whole gave, however, a result which we teach depends upon the state of activity of the organ examined.

We believe it to be useless to attempt to give a bibliography of this question. All the memoirs may be found in the *Comptes Rendus de l'Académie des Sciences* for 1903 and 1904.



### N-Rays.

The following is an abstract from a communication from Prof. R. W. Wood, of the Johns Hopkins University, which appeared in *Nature* (London), September 29th.

The inability of a large number of skillful experimental physicists to obtain any evidence whatever of the existence of the N-rays, and the continued publication of papers announcing new and still more remarkable properties of the rays, prompted me to pay a visit to one of the laboratories in which the apparently peculiar conditions necessary for the manifestation of this most elusive form of radiation appear to exist. I went, I must confess, in a doubting frame of mind, but with the hope that I might be convinced of the reality of the phenomena, the accounts of which have been read with so much skepticism.

After spending three hours or more in witnessing various experiments, I am not only unable to report a single observation which appeared to indicate the existence of the rays, but left with a very firm conviction that the few experimenters who have obtained positive results have been in some way deluded.

The first experiment which it was my privilege to witness was the supposed brightening of a small electric spark when the N-rays were concentrated on it by means of an aluminum lens. The spark was placed behind a small screen of ground glass to diffuse the light, the luminosity of which was supposed to change when the hand was interposed between the spark and the source of the N-rays.

It was claimed that this was most distinctly noticeable, yet I was unable to detect the slightest change. This was explained as due to a lack of sensitiveness

of my eyes, and to test the matter, I suggested that the attempt be made to announce the exact moments at which I introduced my hand into the path of the rays, by observing the screen. In no case was a correct answer given, the screen being announced as bright and dark in alternation when my hand was held motionless in the path of the rays, while the fluctuations observed when I moved my hand bore no relation whatever to its movements.

I was shown a number of photographs which showed the brightening of the image, and a plate was exposed in my presence, but they were made, it seems to me, under conditions which admit of many sources of error.

I feel very sure that if a series of experiments were made jointly in this laboratory by the originator of the photographic experiments and Professors Rubens and Lummer, whose failure to repeat them is well known, the source of the error would be found.

I was next shown the experiment of the deviation of the rays by an aluminum prism. The positions of the deviated rays were located by a narrow vertical line of phosphorescent paint, perhaps 0.5 millimeter wide, on a piece of dry cardboard, which was moved along by means of a small dividing engine. I was unable to see any change whatever in the brilliancy of the phosphorescent line as I moved it along, and I subsequently found that the removal of the prism (we were in a dark room) did not seem to interfere in any way with the location of the maxima and minima in the deviated (!) ray bundle.

I then suggested that an attempt be made to determine by means of the phosphorescent screen whether I had placed the prism with its refracting edge to the



right or the left, but neither the experimenter nor his assistant determined the position correctly in a single case (three trials were made). This failure was attributed to fatigue.

I was next shown an experiment of a different nature. A small screen on which a number of circles had been painted with luminous paint was placed on the table in the dark room. The approach of a large steel file was supposed to alter the appearance of the spots, causing them to appear more distinct and less nebulous. I could see no change myself, tho the phenomenon was described as open to no question, the change being very marked. Holding the file behind my back, I moved my arm slightly toward and away from the screen. The same changes were described by my colleague.

I am obliged to confess that I left the laboratory with a distinct feeling of depression, not only having failed to see a single experiment of a convincing nature, but with the almost certain conviction that all the changes in the luminosity or distinctness of sparks and phosphorescent screens (which furnish the only evidence of n-rays) are purely imaginary. It seems strange that after a year's work on the subject not a single experiment has been devised which can in any way convince a critical observer that the rays exist at all. To be sure the photographs are offered as an objective proof of the effect of the rays upon the luminosity of the spark. The spark, however, varies greatly in intensity from moment to moment, and the manner in which the exposures are made appears to me to be especially favorable to the introduction of errors in the total time of exposure which each image receives. I am unwilling also to believe that a change of intensity which the aver-

age eye can not detect when the n-rays are flashed "on" and "off" will be brought out as distinctly in photographs as is the case on the plates exhibited.

Experiments could be easily devised which would settle the matter beyond all doubt; for example, the following: let two screens be prepared, one composed of two sheets of thin aluminum with a few sheets of wet paper between, the whole hermetically sealed with wax along the edges. The other screen to be exactly similar, containing, however, dry paper.

Let a dozen or more photographs be taken with the two screens, the person exposing the plates being ignorant of which screen was used in each case. One of the screens being opaque to the n-rays, the other transparent, the resulting photographs would tell the story. Two observers would be required, one to change the screen and keep a record of the one used in each case, the other to expose the plates.

I feel very sure that a day spent on some such experiment as this would show that the variations in the density on the photographic plate had no connection with the screen used.—*Electric Review*.

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### N-Rays.

Becquerel shows that the n-rays and  $n_1$ -rays given out by certain bodies, such as compressed wood or calcium sulfid exposed to sunlight, can be completely deflected by a magnet, while the x-rays given out by a Nernst filament are not affected even by a field of 10,000 magnetic units. The n-rays are, as a rule, like the  $\beta$ -rays of radium, and the  $n_1$ -rays like the  $\alpha$ -rays of radium, except that the magnetic curvature of the  $n_1$ -rays is the same as that of the n-rays. The nature of the n-rays emitted by a Nernst filament has not yet been accounted for: they

affect the sulfide screen, but are not deflected by a magnet and have a definite series of very small wave lengths. These are refracted by an aluminum prism and seem to give rise to the  $\alpha$ -rays and  $\beta$ -rays. The latter are free negative electrons, while the former behave like free positive electrons. He also describes some experiments, which enabled him to obtain either n-rays or  $n_1$ -rays from the non-deflected n-rays left after the rest had been deflected off by a magnet. A surface capable of storing the n-rays emits n-rays normally and  $n_1$ -rays tangentially, and vice versa. Nearly all physicists outside of France have remained sceptical, yet the theoretical interest of the investigations of n-rays is very great. We have apparently to deal with light of extremely minute wave length (of the size of a molecule and about one-fiftieth of the wave length of visible light). This means an enormous extension of the known spectrum in the violet direction. Taken together with the investigation of radium rays, the n-rays should enable us to get a distinct conception of the structure of atoms. In radium rays we deal with the projection and impact of electrons; in n-rays we probably have the other disturbances which accompany these processes.—*Electrical World and Engineer.*

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#### The Electric Charge of the Sun.

Among the many interesting topics covered by Section A papers at the International Electrical Congress at St. Louis was "The Electric Charge of the Sun." a paper contributed by Prof. Dr. Svante Arrhenius. Starting with the now well-known principle, first enunciated by Maxwell, that light exerts a pressure in the direction of its motion, the paper points out that the repulsion of comets' tails

from the sun, which so long baffled comprehension, is now readily understood. The total gravitational force of the sun's attraction upon a given mass of matter, say a gram of hydrogen, is the same whether the gram is collected together into a dense compact mass, or spread out over a very large volume. But the pressure of light upon the gram mass depends upon the surface area illumined, and is extremely small when the gram mass is densely compacted, but may be relatively large when the mass is distributed over a large area. In fact, when the diameter of any spherical particle of totally reflecting matter of unit density is 1.5 microns, the particle will be in a balanced condition of force toward the sun at any distance therefrom, the gravitational attraction being equilibrated by the radiant repulsion. For spherical particles larger than 1.5 microns in diameter (sixty-millionths of an inch), gravitated attraction will preponderate; while for small particles repulsion will overcome attraction, as far as the diameter 0.008 micron, for which at unit density, the sun's radiant repulsion would probably be 2.5 times as great as his gravitational attraction.

It is suggested that when an eruption occurs on the surface of the sun, negatively electrified particles are hurled far off into space, of a size so small that they are repelled by light more than they are attracted by gravitation. If the resultant repulsive force were just equal and opposite to the ordinary gravitational attraction, it would take 68.7 hours, or nearly three days, for the negatively electrified particle of sun to reach the earth. Again, if the resultant repulsive force was 1.5 times as great as gravitational attraction, the duration of the journey to the earth would be reduced to 45.9 hours, or approximately two days. The exact length

of time would vary with the size and nature of the particle. As soon as the stream of negatively electrified particles reached the earth, the effect would be equivalent to an electric current penetrating into the atmosphere from above, accompanied probably by auroral display and by disturbances of the magnetic field amounting to what is called a magnetic storm. Observations by several different observers seem to indicate that a magnetic storm on the earth follows any violent eruption on the surface of the sun, by an interval of time of nearly two days (42.5 to 45.9 hours) after the sunspot comes directly opposite to the earth, an interval agreeing well with the above calculation.

By shooting off negative electrons into space, the sun must tend to become positively electrified in corresponding degree, and electrostatic force will aid gravitation in attracting the negatively electrified particles. When the sun's positive electrification became sufficiently great, the negative electrons would be attracted by gravitation and electric force more powerfully than they were repelled by light and the shooting off into space would stop. Moreover, all negatively electrified particles within a large range, say one-tenth of the distance of the nearest fixed star, would be drawn into the sun, thereby tending to reduce its positive charge. According to this view, therefore, the sun is a large alternating electric machine in which the period of alternation is about eleven years. During the period there is first a shooting off into space of electrons with an increasing resultant positive charge, and then a recoil or an absorption back from space of negative particles, with a diminishing charge. The earth, as a target, receives a part of the negative shower, and in its consequent electromag-

netic phenomena naturally give evidence of the same eleven-year cycle, as observed. —*Electrical World and Engineer.*

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#### The Magnetism of the Earth.

The International Electrical Congress paper, by Dr. L. A. Bauer, in Section A, forms an important contribution to the textbook literature of the earth's magnetism. The study of the earth's magnetism is the oldest magnetic research on earth. It is a wonderful riddle and several centuries have successively made guesses at it without much success. Nevertheless, the nineteenth century accumulated a large mass of information concerning the superficial distribution of the earth's magnetism. A number of sets of magnetic charts have thus been produced, for different periods of the century, showing the declination, inclination and intensity of the earth's magnetism at nearly all parts of the world except near the two poles. Curiously enough, the magnetic observations accumulated over the ocean-covered areas of the earth have fallen off in number and in precision during the last half century, owing to the general adoption of steel vessels, on which the large local deviation of the compass needle, due to the ship's magnetism, makes accurate measurements of the earth's magnetic field at sea almost impossible. The steel vessel has driven the natural magnetic field off the sailor's path as completely as the trolley car has driven the magnetic observatories on land away from the haunts of civilized man.

The paper points out that it is not difficult to show that much the greater share of the earth's magnetism has its origin underground rather than above the ground. It has been shown that electric currents or magnets outside the earth can





FIG. 1.—X-RAY TUBE OPERATING PROPERLY.





FIG. 3.—APPEARANCE OF X-RAY TUBE WHEN OPERATING AT  
VERY LOW VACUUM.





have very little share in the magnetic distribution at the surface which is marked on our charts. The analysis made by Gauss and others since his time of the earth's magnetic distribution indicates that about two-thirds of it is such as would correspond to a simple homogeneous magnetization of the earth's mass about an axis of symmetry which is also a diameter of the earth and inclined to the polar diameter by a moderate angle. This homogeneous magnetization has been called the primary magnetization and the share of the total evident magnetic field due thereto—the primary magnetic field or the principal magnetic field. The residual magnetization and magnetic distribution seem to be closely related to temperature distributions in and over the earth's surface. Curiously enough, a comparison of the latest magnetic observations with those made about 1840 or 1850, seem to indicate that the earth's magnetism has fallen off about three per cent during the interval intervening. The shrinkage is unexplained. If it really existed and were to continue, the earth's magnetism would almost entirely vanish in a few thousand years.

A small part of the earth's residual magnetic field appears to be due to external radial currents, i. e., electric currents passing either from the earth's surface upward into the atmosphere and beyond; or, oppositely, downward from the at-

mosphere down to the earth. By the application of the well-known magnetic principle that the curl of magnetic force around any area is equal to  $4\pi$  times the surface integral of electric current thru the area, it has been shown that there is generally a very appreciable vertical current component to or from the earth. In other words, the curl of the magnetic force around any given territory does not in general vanish, as it should if there were no vertical electric current distribution thru the territory, but leaves a distinct residual quantity, positive in some regions of the earth and negative in others. The corresponding average distribution of current reaches a maximum of about forty milliamperes per square kilometer, either upward or downward. The paper shows that in a general way this vertical current distribution appears from the computations to be upward over those regions of the earth near the equator and elsewhere over which the atmospheric currents are known to be rising; and that similarly the electric currents appear to be downward where the atmospheric currents are generally descending. Consequently, it may be possible to account for the vertical magnetic component in the earth's residual distribution by the convective transportation of positive electricity upward or downward in the general atmospheric circulation.—*Electrical World and Engineer.*



## Psychic Forces.

BY DR. C. O. SAHLER, KINGSTON, N. Y.

A little child only twelve years of age, weighing but sixty-five pounds, is able to express great psychical power. Her name is Stella Lundelius. She lives at Port Jervis, N. Y. Her first public introduction was at my sanitarium a year ago. I learned of the child through a patient from that town. This patient had heard much talk about her in her home town, but had never seen the child exhibit this peculiar power, although she had seen her many times. Being interested in this line of thought, I invited her father to pay me a visit, so the father and child came to the sanitarium and spent two days and nights with us. The father is a photographer and a very intelligent man, one who has made a good deal of investigation in his own way along psychic lines. He possesses hypnotic power. The mother of the little girl is a medium. The child is, as I said, twelve years of age, a refined, natural child. During the past year, thru the New York *Herald* and other papers, she has been brought to a great notoriety, but it does not disturb her in the least, as all curiosity and flattery have not aroused the least vanity in her nature. She has the mental-motive temperament, with a refined spiritual nature; a child who would not be singled out as one possessing any peculiar psychic power. When she appeared before the people of the sanitarium there were over a hundred present. In one evening I saw more than thirty or thirty-five different ones attempt to lift her, and fail in the attempt. The part which she played in this program was very simple. She would walk into the middle of the room, when any person had the privilege of lifting her by placing his hands under the

arm pits, which to an ordinary man was a very easy thing. Then without regard to any special position, she would simply touch the neck or the wrist of the lifter with one finger, using either hand. To her this seemed to create an impression of contact and then if a man attempted to lift her he would find that he could not do it. I saw one gentleman, weighing 225 pounds, try a number of times and he could not lift her from the floor enough to slip a sheet of paper under her feet. I made the attempt a dozen or more times myself, and could not do it. When she did not touch my body with her finger I could place the index finger of each hand under the arm pits, and raise her up with ease, at arms' length, two or three feet from the floor; but the moment she put her hand upon mine, or touched my body anywhere with her finger, I could not, even with both hands, thoroughly grasping her body under the arms, possibly raise her. During her two days' stay at the sanitarium, nearly a hundred people made the attempt to lift her, and all failed, with the exception of four individuals. One of these was a man who was a very gross skeptic, the other three were patients of mine, two being small in stature and all three very low in magnetic power and all three not in good health. They could lift her whether she touched their bodies or not. During the day she was around thru the city at business places, and there was so much talk concerning her that many outsiders made the attempt to lift the child, but in every instance failed. Unlike the Georgia Wonder she did not either ignorantly or intelligently resort to any law of mechanics by having some special method or position



whereby the tests must be made, but individuals pursued their own methods, merely clasping her around the body under the arms, lifting without standing up against her with their bodies, and she being of such light weight, it was no trouble to lift her at arms' length except when she willed otherwise. In making these tests she did not resort to any muscular tension or resistance, in fact, she stood almost limp, without the slightest muscular energy to combat those who attempted the lifting.

This phenomenon was first discovered by the father when she was but a little child playing on the floor. Sometimes he would discover that she was extremely heavy, and at other times stemed very light. During her childhood he always attributed it to something peculiar in himself, but as she grew a little older he discovered it had nothing to do with himself, for if others attempted to lift her she became so heavy it was with difficulty they accomplished it. After weighing these experiments I formed the opinion that it was due to her own direction of her psychic forces. I endeavored to ascertain if it was something entirely within her, or if others possessed the same power. I made tests with several individuals and I found one gentleman especially, weighing about 150 pounds, who, when given the suggestion in the hypnotic state (and by this I mean only physical hypnosis, for in every other particular he was perfectly normal) that he was so heavy a strong man would find it impossible to lift him, proved to be so.

I had a number of gentlemen, one weighing over 200 pounds, and an athlete, attempt to lift him, and they could not do so, even by clasping the arms right about the subject's body or waist. I would then alternate—suggest that he was normal in weight and that an individual could lift him, then after giving the suggestion that he was abnormal the lifter would perceive the great change immediately. By these tests I proved to myself that the little girl, possibly through some hypnotic influence of the father in childhood, while in childish play, imbibed the thot from the father that she was heavy. Later, her ego endowed the body with a great amount of psychic force, which made her heavy, and this condition had been gradually developed thru childhood into girlhood.—*Suggestion.*

[A reliable friend told me of a test he made with a lady who was a similar psychic and whom he accidentally met at a railway station. When she allowed him to do so he could lift her with ease. When she willed otherwise and touched him he felt a sudden muscular weakness, and knew then that his next attempt to lift her would be a failure.

The statement that such an effort is due to "suggestion" or to "will power" means nothing. Suggestion is a term which now includes all kinds of forces that may act on the organism. But what is desirable is an investigation of the conditions which favor or hinder the exercise of such powers, with a view to their application in education and daily life.—EDITOR.]



## Electrolysis and Catalysis.\*

BY PROF. W. OSTWALD, M. D.

The chemical result of the conduction of an electric current thru an electrolyte is made up of two very different effects, namely, the phenomena of the *conduction* thru the electrolyte and those concerned with the *transfer of electric charges* at the electrodes. With respect to the first effect we have clear and definite conceptions based on the universally confirmed theory of Hittorf. According to this theory, the mechanism is of the greatest simplicity, namely, the kations and anions migrate in opposite directions and with mobilities which depend mainly on the specific nature of the ions, but also on the solvent, the concentration and the temperature. The process which results in the second effect—namely, the ionic discharge or the general transfer of charges at the electrodes—also seemed at first to be simple and clear. But the assumption that the ions which accomplish the transportation of the current thru the electrolyte are also the materials which undergo the electric change at the electrodes, could not be supported; it was the recognition of the very fact that both can be different, which made possible the development of the proper explanation of the phenomenon of electrolytic conduction itself. Berzelius still based his electrochemical system on such an incorrect conception of the electrolytic phenomena. He at first and chiefly tested the salts of the alkaline metals and earths; since *bases* and *acids*, besides hydrogen and oxygen, result from their electrolysis, he regarded the former two substances as the real constituents of the salts, and based his entire chemical system on this misconception derived from

his experiments. Even Faraday held rather erroneous views in this regard, though we owe to him the name and conception of the ions. The first one who was consistent was Daniell, who throughout assumed the metals to be the kations of the salts. The scientists' conception of the mechanism of the transportation of electricity by the ions was still imperfect, and it was Hittorf who then worked out the theory in this respect and reduced it to a perfectly simple and clear one; to him we owe the statement that electrolytes are salts, and the experimental methods for determining the nature of the ions in every given case, as also the ratio of their migration velocities independently of any possible electrode reactions.

The new idea of decisive importance was that of a *secondary reaction*. While by the conduction of the current thru the electrolyte a certain ion may be transferred to the cathode, it does not necessarily follow that it is deposited or liberated there. In a solution of potassium chlorid it is undoubtedly the potassium ion which transports the positive electricity to the cathode. Yet it does not appear there as the product of electrolysis, but in its stead, potassium hydroxid and hydrogen are formed. This is explained by the conception that directly or primarily potassium is deposited, which, however, can not exist in contact with the water of the solution and reacts with it, forming potassium hydroxid and hydrogen.

First of all, this view enables us to conceive the same simple mechanism for the conduction of the current thru an electrolyte, in the two theoretically fully analogous cases of the electrolysis of the salts

\*A paper presented at the International Electrical Congress of St. Louis, 1904.

of heavy metals which do not decompose water, and the electrolysis of the salts of light metals which decompose water, altho both cases are apparently quite different from an experimental point of view. Another result is that the apparent contradiction of Faraday's law is avoided which, in the case of electrolysis of salts of light metals, could be found in the fact that, besides the liberation of oxygen and hydrogen, the formation of acid and alkali appear as immediate effects of the electrolysis. Finally our view gives an explanation of the fact that in some cases, instead of the secondary reactions, it is possible to get the primary products by means of a slight modification of the conditions of the experiment. For instance, in the case of the alkali metals this is possible by the use of a mercury kathode.

In the course of time the necessity has manifested itself to consider a great many reactions as secondary. The best known example is the decomposition of water between inert electrodes. Since water itself is a poor conductor, alkali or acid is added, and in former descriptions of this method it was stated that these additions are made only for the purpose of rendering the water a "better conductor." Now we know with sufficient certainty that the conduction of the current is really accomplished by the ions of the additions, and, in the case of an acid, we consider the oxygen developed at the anode as the result of a secondary reaction between the discharged anion and the solvent water, while in the case of an alkali we must assume secondary reactions even at both electrodes, namely, at the kathode the reaction between alkali metal and water and at the anode the change of the discharged hydroxyl ions into oxygen and water.

By the development of modern electro-

chemistry our views on these questions have been modified so as to be more precise. If at an electrode several processes are possible by means of which the transfer of electricity from the electrolyte into the electrode may take place, we have to assume that that reaction will take place for which the potential difference is a maximum. Or, in other words, if we gradually increase the e. m. f. applied at the terminals of the cell, beginning with zero e. m. f., then, of all possible ionic discharges, those will first occur which require the smallest potential difference.

However, the potential difference for any electrode reaction has in general no constant value, but depends upon the temperature and to a considerable degree upon the *concentration*; the range of the strongest influence is exclusively at *low* concentrations. If we start from "molar" solutions and increase the concentration, we can not go beyond ten times molar concentrations for experimental reasons, because more concentrated solutions of electrolytes can not in general be prepared. Within the limits mentioned, the maximum possible difference is about 0.06 volt for the electrolytic production of any constituent of these solutions out of the concentrated or out of the dilute solution. On the other hand, if we start again with molar solutions and decrease the concentration, the same difference of e. m. f. (0.6 volt) is found for every decrease of the concentration to one-tenth its former value; hence for 0.001 molar solutions compared with molar ones, it has already increased to 0.17 as a maximum, and for 0.000001 molar solutions it is twice as great. For infinitely dilute solutions it is theoretically infinite, but experimentally one does not exceed two volts.

The following important conclusion



may be drawn herefrom. If there are several possibilities for the reaction at one electrode, the chemical reaction which really occurs depends not only upon the nature of the possible chemical reactions, but also upon the concentration of the substances which are present, and by suitably varying the latter we can bring any reaction to any point in the voltage series.

Now it is a universal fact that the electrolytic process itself results in a decrease of the concentration of that substance in the neighborhood of the electrode which is involved at that moment in the electrode reaction. Hence, any such reaction has the tendency to stop by itself and to be replaced by that reaction which can and will take place as the next one with increasing voltage. Moreover, since the voltage is influenced only by the concentration *at the electrode itself*, not by the average concentration in the whole electrolyte, this "polarization" would necessarily take place almost instantaneously after the current has begun to flow, if there were not other processes which bring the exhausted kind of ion again in sufficient quantity to the electrode.

These compensating influences are of a twofold kind. First, we have diffusion which tends to make good any decrease of concentration with a force proportional to the existing concentration difference. Secondly, we may have chemical reactions which are caused by the exhaustion of the electrolytically changed ions, since the equilibrium which had been disturbed by their disappearance begins to reconstitute itself and, therefore, also tends to counteract the loss. Both compensating processes, however, start only after the loss had been established, and are, therefore, never able to reproduce the original condition. The result is always a polariza-

tion, i. e., an e. m. f. which counteracts the applied e. m. f.<sup>1</sup>

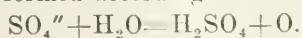
The value of the e. m. f. of polarization evidently depends upon the final decrease of concentration of the electrolytically changed ion. For this purpose we have to consider the stationary condition which is reached after the first variable processes have terminated. For the case in which the compensation for the exhausted ions is accomplished by diffusion only, Helmholtz has already given the underlying principles of the reaction. These may be briefly summarized as follows:

The current causes a consumption of the active ion at the electrode surface, the quantity consumed being proportional to the quantity of electricity which has passed. But the electrolytic migration of the ions does not bring as many new ions to the kathode as are consumed; it brings only a certain portion of this number, this portion being given by the ratio of the migration velocity of the active ion to the sum of the migration velocities of both ions. Hence there must necessarily result ionic exhaustion which is counteracted by diffusion. The exhaustion progresses so far until diffusion—which simultaneously increases on account of the increasing concentration difference—brings back to the electrode exactly the missing amount of ions in the form of its salt. There will, therefore, be produced finally a certain distinct concentration difference between the electrode surface and the main part of the solution, and there will be a corresponding distinct e. m. f. of polarization. Since the diffusing quantity of salt is proportional to the coefficient of diffusion and to the *difference* of concentration,

<sup>1</sup>There are known a few cases of abnormal polarization in which the current causes an e. m. f. of polarization of the same direction as the applied e. m. f.; their theoretical explanation is possible on the basis of the theory given in what follows.

while the e. m. f. of polarization is proportional to the *ratio* of the concentrations, it follows that with the same current density the e. m. f. of polarization must become the greater the lower the total concentration of the active ion.

These considerations hold good directly for primary electrolysis in which the current is transported by the same ion which undergoes the change of concentration at the electrode. For secondary electrolysis we have only to consider what the influence of the current will be, according to Faraday's law, upon the concentration of the electrolytic ion at the electrode. Let us consider, for instance, the case of "water decomposition," and let us distinguish the two cases in which, for increasing the conductivity, an acid or a base is added. With an acid solution we have to consider at the kathode the concentration of the hydrogen ion and we then have primary electrolysis. At the anode we had to consider first the concentration of the anion, for instance the  $\text{SO}_4$  ion. By its reaction with water, oxygen and sulfuric acid is formed according to the equation



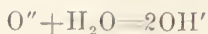
i. e., this process yields sulfuric acid which disintegrates again into its ions. The concentration of the  $\text{SO}_4$  ion is, therefore, not diminished but increased, and this increase corresponds exactly to the decrease of the concentration at the kathode. Diffusion will now carry away the sulfuric acid from the anode and this will lead to a stationary condition. The total result is not a compensation of the two e. m. f's. of polarization at the electrodes, but since an *increase* of concentration has a smaller influence on the potential than an equal *decrease*, we will ultimately have a polarization in the ordinary sense, i. e., the passage of the current is rendered more difficult, and this will be the case

to a greater extent the higher the current density and the smaller the total concentration.

If a caustic potash solution is electrolyzed, we have a similar increase of the potassium hydroxid concentration at the kathode, due to the ionic migration, since it is not removed there from the solution, and we thus have here quite similar conditions as exist for sulfuric acid near the anode. At the anode we have, in the case of caustic potash electrolysis, the reaction  $2\text{OH}' = \text{H}_2\text{O} + \text{O}$ . The concentration of  $\text{HO}$  is approximately proportional to that of the potassium, but the latter decreases on account of the migration of the ions. Furthermore, immediately at the anode a layer of pure water is formed. The total result in this case is again a polarization in the ordinary sense.

All these considerations are based, however, upon the further supposition that *the chemical reactions by which the secondary products are formed occur with a speed which is infinitely great in comparison with the other processes*. This is a supposition which, while very approximately fulfilled in the cases which we have considered, yet is not necessarily fulfilled in all cases. If we have to do with reaction velocities which are not infinitely great, there arise a great many new questions which we had no need of answering so far.

It may be asked, for instance, whether at the anode in a potassium hydroxid solution, the secondary reaction  $2\text{OH} = \text{H}_2\text{O} + \text{O}'$ , or even  $4\text{OH} = 2\text{H}_2\text{O} + \text{O}_2$  occurs, or whether we do not have a primary reaction, namely, the discharge of bivalent oxygen ions. True, the existence of such an ion as  $\text{O}''$  has not yet been proved; it can never exist in considerable quantities, because it soon reacts with water according to the equation



and forms hydroxyl ions. On the other hand, one may state that it must always be present in very small quantities wherever hydroxyl ions are present, since the above reaction also takes place in the reverse direction, as read from the right to the left hand of the equation, and the simultaneous concentrations of the two kinds of ions are determined by the (unknown) equilibrium constant of this reversible reaction. As long as this reaction also takes place with a speed which is infinitely large compared with that of the electrolytic processes, it does not matter which reaction is assumed, since no measurable quantity is thereby influenced; it is, therefore, not possible to decide which of the different possible reactions really occurs and a discussion of this point does not fulfill any useful purpose.

Let us now imagine the possibility of rendering the reaction between hydroxyl ions and bivalent oxygen ions infinitely slow by some means. It would then be possible to decide which of the two reactions occurs at the electrode (under the supposition that it is either the one or the other). If it is the hydroxyl ion which is discharged, the decrease of concentration, produced by a given current, will have a relatively much smaller effect than an equivalent decrease of concentration of the oxygen ion which is present in a much smaller concentration. Under equal conditions we would, therefore, get a small polarization in the first case and a very strong polarization in the second case; and by measurements of the polarization we could decide which of the two reactions really takes place.

Such means of changing the speed of a given reaction within very wide limits really exist in chemistry in what is called *catalyzers*. From this it is at once evi-

dent what a very essential and important part the catalyzers are able to play in electrolytic action. By retarding one of the possible reactions by means of a negative or retarding catalyzer, we are able to *exclude* its influence from the electrolytic process. By accelerating by means of a catalyzer a reaction which is of itself slow, we can *include* it in the electrolytic process. In other words, we are no longer compelled to let the current act in the way stated by the above simple law, but, in principle, we are now able, *by applying suitable catalyzers, to prescribe to the current that reaction which we want to have to take place*, and it does not matter at which point of the voltage series this reaction is situated.

This fundamental idea may be applied in two directions. First in *synthetic* work; if we suppress by negative catalyzers those reactions which would take place before the desired one, we can bring the desired reaction to the front; or if the reactions which take place before the desired one occur with a low speed, we can accelerate the speed of the desired reaction by means of a positive catalyzer and can thus produce the same effect. The second application is *for analyzing the reactions which really take place at the electrodes*. If these reactions are essentially influenced by a certain addition, and if we know the single reaction which is altered catalytically by the addition, we can conclude that this reaction takes an essential part in the electrode process. If a catalyzer of known specific activity does not influence the electrode reactions, we can draw the reverse conclusion and state that that reaction is not a part of the electrode process.

In connection with this, it should be emphasized that what is called above briefly *the electrode process* is in reality a



rather complex phenomenon. In the simplest case—for instance, in the primary electrolysis of a silver salt—this reaction consists in the change of the silver ion to metallic silver. But “metallic silver” is not a well-defined substance, since we know elementary silver in very different allotropic states. Here the very general rule manifests itself that a system, when changing from one state to another one, first assumes the unstable intermediate states which change step by step into the more stable ones; in the case of explosive antimony, detected by Gore, it is well known that one of these states remains metastable for a longer time. One may say, therefore, that the first product in the cathodic deposition of silver is that which is formed as the next step from the silver ion after the loss of its positive charge, i. e., silver dissolved in water, probably of the molecular weight of Ag. On account of the presence of white metallic silver the silver can not continue to exist in this state, but changes into the stable form of white silver. At the cathode a distinct proportion of dissolved silver ions to dissolved silver metal will, therefore, be established, and this proportion will determine the potential by means of an equation similar to that given by Peters<sup>2</sup> for the potential of a mixture of ferrous and ferric salts. The greater the speed of the change of dissolved silver into the white solid metal, the smaller will be the concentration of the dissolved silver metal and the more it will approximate that which is given by the self-solubility of white silver<sup>3</sup> and which, therefore, represents the equilibrium potential of a silver electrode.

Similar considerations hold good for the secondary reactions at an electrode. Thus, as the primary anodic product of the electrolysis of dilute sulfuric acid, a

substance  $\text{SO}_4$  may be assumed which reacts with the solvent water with any (probably very high) speed, to form oxygen and sulfuric acid. In the case of concentrated sulfuric acid, which contains mainly the ion  $\text{H}'\text{SO}_4$ , is is not the substance  $\text{HSO}_4$ , but its polymerisation product  $\text{H}_2\text{S}_2\text{O}_8$ , which is obtained, or its ions, as the conceivable primary product. If, however, the anode has too strong catalytic properties, for instance, if it consists of a large platinum plate, the persulfuric acid which is formed soon disintegrates into sulfuric acid and oxygen, and the unstable intermediate product does not remain.

It will thus be seen that even the simplest electrode reactions are made up of a plurality of reactions following each other step by step. Since each of the same can be influenced catalytically, it is already evident that a very great variety of results is possible. We should furthermore consider that many of the unstable substances which are formed as intermediate products during electrolysis, and which quickly disappear, are not yet known separately with respect to their properties, and especially with respect to the action of catalyzers upon the same. Under these circumstances it will be evident what an abundance of peculiar and unexpected phenomena we may hope to detect in this way, and how much new knowledge we may expect to obtain from a systematic investigation of this field. The literature of electrochemistry already contains a great number of separate facts which are not only understood more easily, but applied with greater safety, if considered from the points of view given in this paper.

2. *Zeit. f. Phys. Chemie*, v. 26, p. 200, 1898.

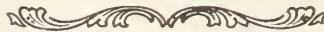
3. Such a solubility must be assumed in any case. This follows from general reasons and from the facts, detected by Naegeli, of the accumulating poisonous action, the “oligodynamics” of water in contact with metallic silver.

per (a large portion of which was suggested by other scientists, since, about six years ago, I emphasized the necessity of taking into consideration catalytic action in the investigation of the phenomena of electrolysis). I regret that I can not go into details; I wish to remark only that for some time Professor Luther, with his scholars, has attacked this problem from different sides; the papers already published by them, and still more the unpublished investigations, will show the generality and variety with which this scientist has understood developing this principle and rendering it useful.

#### **New Theory of Cancer.**

It is not so long ago that a foremost scientist expressed himself doubtful as to whether the secret of the cancer-cell would ever be solved; it is therefore encouraging to encounter a new plausible theory, based upon accurate observation. In brief, G. Kelling (*Muench. med. Woch.*, June 14, 1904) believes with the older authors that the cancer cell is an embryonal cell endowed with all the energy of growth of young tissue; his theory differs, however, in that he does not regard it as a modified normal cell, but as altogether foreign and introduced from without. Thus, embryonal cells are often ingested in raw eggs and the larvae of certain fish form a sta-

ple article of food. It is even possible that insects may inoculate these cells directly into the blood. Numerous experiments bear out this view, and the author was able to produce malignant neoplasms (malignant adenoma, carcinoma and sarcoma) in every case where comminuted embryonal tissue was injected into the veins of dogs. Still more convincing proof was obtained by the precipitation test. Several pyloric cancers, removed at operation were communicated and injected into rabbits in increasing doses. The serum of these animals precipitated the extract of the cancer employed, human albumin and chicken albumin, but not albumin from any other source; thus making it exceedingly probable that the cancer cells took their origin from the embryonal tissue of ingested eggs. In support of the heterologous origin is the fact that nobody has observed the transition of normal into malignant epithelium even in the most early growths. It is a well known fact in biology that all cells of one species possess the same number of nuclear chromosomes; cancer cells differ, however, in this respect from the other cells of the body. Furthermore, the cells behave differently toward x and radium rays and possess a different osmotic pressure, and there can hardly be any doubt that they are foreign. —*Medical News.*



## Spleno-Medullary Leukemia Cured by the X-Ray.

BY THOMAS B. EASTMAN, M. D., INDIANAPOLIS, IND.

The reduction of the spleen to a size at least approaching normal is a *sine qua non* as in the cases observed where death finally resulted the spleen could not be materially reduced. In short, the blood count is not always an infallible index of the patient's condition or of the prospect of cure.

The patient was a young man twenty-one years of age, thin, pale and giving every evidence of profound exhaustion. He gave a history of being quite well up to the time he had spent several months in a lumber camp in Arkansas, where malaria was prevalent. Some time before he left the camp he noticed on the left side, under the short ribs, an enlargement which gradually grew in size until when I saw him the tumor occupied the entire left abdomen from a point on the level of the ensiform cartilage to Poupart's ligament and extending two inches to the right of the umbilicus thru its entire inner border.

There was pain and tenderness over the mass; the notch could be distinctly felt. The pulse was 110 and full in volume. The apex beat of the heart was heard an inch above the normal point. He was very short of breath. There was edema in the feet. He had had nose bleed. There were few gastro-intestinal symptoms. He complained of headache and was so dizzy that he could not stand alone. His temperature was 100.6. Having no means at hand for examining the blood, I made a provisional diagnosis of spleno-medullary leukemia and put him on arsenic, quinine and tonics. There was no improvement.

On reading the report of a case of spleno-medullary leukemia cured by Senn by the x-ray I determined, after having had the young man examined by Dr.

Frank B. Wynn, to give this treatment a trial.

An early blood count showed the following: Red cells, 3,000,000; white cells, 1,110,000. Differential count: Myelocytes, 11 per cent; eosinophiles, 2 per cent; normoblasts were present in small number, averaging about two such cells per field, No. 7 Leitz lens. A few erythroblasts were seen, polymorpho-nuclears, 67 per cent; lymphocytes, 18 per cent. In cover glass preparations this blood presented a picture not to be mistaken. The ratio of whites to red, about one white to every three red cells, the presence of large numbers of myelocytes, the presence of a large number of eosinophile cells and nucleated red blood cells fully confirmed the clinical diagnosis of leukemia of the spleno-medullary variety.

Without receiving any treatment whatever other than the x-ray treatment, he began to improve. A medium vacuum tube was used over the region of the tumor and the ends of the long bones ten minutes daily. The condition of his blood improved. There was marked decrease in the size of his spleen.

The patient desiring to be nearer home, the treatment was continued by Dr. J. P. Hetherington, of Logansport. About the fifteenth week of treatment the blood count did not seem so favorable as it had earlier in the treatment, altho the spleen continued to diminish in size and the patient's condition to improve. At the end of five months he was working in a lumber camp near his home. At the present time the spleen is not more than one-fifth larger than normal and the blood count is normal. He is apparently in perfect health.—Abstracted from *Denver Medical Times*.



**Treatment of Tubercular Glands by X-Rays.**

In the *Australasian Medical Gazette* of May 20, 1904, Beckett writes enthusiastically of this method of treatment. He says that excision can not be regarded as a cure; it is merely the best expedient to be adopted in face of a confessed inability to cure. There are two reasons why the operation has to be very often repeated: first, the impossibility of drawing any certain line of demarcation between the infected and non-infected glands; and secondly, the surgeon's knife does not attack the cause, but the effect of the disease. The infected glands are not the primary cause, but the result of infection that has been incurred elsewhere, so that if even the whole of the infected glands is removed it is quite possible for others to follow on the same course. The same thing can be seen after the removal of the tonsils by excision, as we know it is no uncommon experience to find after the tonsils have been removed that in a few months the enlargement is as great as ever. The question of disfiguring scars is no trivial one to any young woman, and many of these patients are such. On the other hand, by the x-ray treatment, if carefully done, there is no disfigurement (altho the writer admits that if care is not exercised the neck may be badly marked for a time, but this usually wears off, and can generally be avoided altogether by a careful operator). Above all, the beautiful way in which, in a suitable case, these glands disappear forces the writer to believe he is not claiming too much in describing it as a process of actual cure, which can only be explained on the assumption that the rays act not only on the glands, but also on the primary source of the disease. He invariably finds that the patient gains weight and improves in health. The only drawback is that some

time and trouble is required; but the results are so much better, in his opinion, than by operation that he believes most persons would prefer it, and when the facts are better known the operations for excision of the glands will pass into the limbo of the discarded and needless operations.

In regard to the method of treatment, as so much of this work is largely a question of time and patience, nothing can be accomplished in a few days or a few exposures. The writer uses a powerful coil and a current of large amperage, giving five-minute exposures two or three times a week. As might be expected, it is advisable to use tubes in the highest practical state of vacuum to obtain as deep penetration as possible, and also because these tubes give other advantages specially suitable to these cases. In the first place such exposures are rather severe, and with ordinary low, or comparatively low, vacuum tubes the difficulty is with the dermatitis, which arises and compels the treatment to be suspended for a while. The author finds it possible to give longer exposure and can use stronger currents (that is, up to 8 to 10 amperes) before the dermatitis becomes troublesome by using strong tubes. In some cases marked pigmentation takes place, which may last for a time after the treatment is suspended, but this is not permanent, and in time, as the skin is renewed, it entirely disappears. Some modification is required in individual cases as experience suggests. In cases where suppuration has already commenced the writer's practice is to open and drain through a small opening, keeping open as long as necessary. These wounds heal readily and do not show any tendency to suppurate again.

Treatment varies in length of time according to the severity of the case; rough-

ly speaking, from one to three months is the rule, but the writer has taken longer. He also sometimes uses the high-frequency currents in conjunction, but regards the x-rays as the main factor in the cure, and that is another of the reasons why he prefers a very highly exhausted tube, as a certain amount of high-frequency currents are being given off all the time; and if a low vacuum tube is used no good effect seems to result. The enlarged glands disappear very slowly, and even at the end of the treatment can still be detected, but the improvement continues afterward

until they entirely disappear. One marked feature is the decided improvement in the bodily health of the patient that takes place. They nearly always gain weight. Enlarged tonsils, which are also often present, also subside, from which he believes this treatment would be as beneficial for such cases, and might well be tried before resorting to excision. As regards the prospects of recurrence, he expected to find that would take place, but so far he has not seen it happen, and merely regards recurrence as an indication of insufficiently prolonged treatment.—*Ex.*



## The Use of the X-Ray in the Diagnosis of Diseases of the Bones.\*

BY E. A. CODMAN, M. D., BOSTON, MASS.

My particular hobby in x-ray work has been "interpretation." By the interpretation of a plate I mean the drawing of conclusions from it as to the actual anatomical or pathological condition of the part which has been taken. I fear that I have neglected electrical and photographic technique shamefully, for I have felt that the thing which is worth a physician's time in x-ray work is his ability to draw conclusions from his plates after they are taken. Any man without a medical education may soon learn to take a technically good x-ray picture, but it requires an accurate anatomical and pathological knowledge to interpret one correctly after it is taken.

The structures of machines, coils, tubes, anodes and kathodes may be changed indefinitely in the next twenty years, but the anatomy of the bones and the manner in which they are affected with disease will

be the same, and it is with these same diseases that experience in interpretation will prove valuable. The ultimate object is to obtain knowledge which will assist in curing the disease. To this end there are four steps.

1. The knowledge of the essential characteristics of an x-ray picture, i. e., that it is a projection or chart of the densities of the different parts of an object.

2. The knowledge of normal x-ray anatomy, i. e., the appearances made by the normal bones in an x-ray picture.

3. The knowledge of the pathology of different forms of bone disease, i. e., the exact manner in which each invades the bone.

4. The ability to reconstruct a picture of the pathological conditions in the individual case from the inferences deduced from x-ray pictures of it.

When we have a competent knowledge of these four essentials we may reason as follows:

\*Read at the meeting of the Maritime Medical Association, July, 1904, and published in the *Canada Lancet*.

An x-ray may differ from the normal appearance of the tibia in that it shows a thickening of the cortical bone of the shaft. Since the shaft is affected, it is more likely to be syphilis than tuberculosis, which almost invariably affects the epiphysis. Since there is no loss of bone substance or formation of a sequestrum it is not osteomyelitis. The patient is young, therefore it is not Paget's disease. There is no chronic lung disease, therefore it is not osteo-arthritis pneumonica, etc. Sherlock Holmes would have been a great interpreter of x-ray pictures.

Let me speak a little more fully of each of my four divisions.

1. *The knowledge of the essential characteristics of an x-ray picture.*—The x-ray picture or skiagraph is not like any other kind of a picture we are familiar with. I have racked my brains to try to find something to compare it with. My best definition is a chart of the densities of the different portions of an object. Stop to think a minute! It is not a shadow, for a shadow is merely an outline bounding a homogeneous interior. It is not a photograph, because a photograph shows merely outline and the surface. It is not a median section, for a median section gives no idea of what lies on either side. It is not a picture of an interior, for you may see it in portions of the object which are on both sides.

It really shows much more than any other kind of a picture with which we are familiar, for, like the shadow and the photograph, it gives the outline, and, like the median section and interior view, it gives some knowledge of what lies inside the bone. To this Maritime Medical Association I may compare it to a graphic representation of a chart of soundings where, instead of the number of fathoms, is registered, in black and white, the num-

ber of atoms which each ray meets in traversing the bone. The less the number of atoms met in each portion of the bone, the deeper and darker will be the imprint left by the ray on the plate.

One must remember that the greater the atomic weight of an object or substance the more obstruction will it offer in the path of the ray. This is equally true of each little part of that object or substance.

I need not remind you, too, that the portions of an object which are not in contact with the plate, are enlarged because the light radiates from a single point. In this, skiagraphs resemble shadow pictures.

2. *The knowledge of normal x-ray anatomy.*—X-ray anatomy differs greatly from the osteology which we learnt at the medical school. We then learnt to describe the surface of bones, and paid little attention to the density of their various parts. In the x-ray picture we recognize the bones entirely from their outline unless we happen to remember the look of their sections, but in the x-ray the outline surrounds a chart of densities instead of surface markings. In the skiagraph the sustentaculum tali and the unciform process appear as dense rings in the middle of the os calcis and unciform bone, instead of protuberances on their surfaces. The epiphyseal junctions in children appear as irregular overlapping ellipses. The olecranon fossa seems like a hole in the lower end of the humerus.

3. *The knowledge of the pathology of different forms of bone disease.*—I mean by this especially, the particular modes in which each disease invades the bone. How have our predecessors in medicine learned to classify the different forms of bone disease? By the study at operations or autopsy of the different characteristics of each disease confirmed by the clinical history and the microscope. For instance,



in syphilis of the bone, they have given us the following facts:

A syphilitic bone has no odor. The x-ray can not tell us this.

Gummatous infiltration of a bone is not purulent, but a grayish or yellowish granulation-like tissue. The x-ray can not tell us this.

The surface of syphilitic bone is rough to the touch and the periosteum adheres with more than ordinary tenacity to it. But the x-ray can not tell us this.

So we might go on with other diseases mentioning many things which the x-ray will not tell us.

Those of us who have had experience do not expect to tell how a bone smells, or how it looks in cross section, or how it feels on the surface. We may, however, infer how it smells, or how it looks, and how it feels after we have found out some of the other things; for, fortunately, our predecessors have told us other things about syphilis of the bone.

For instance, syphilis almost always affects the shaft instead of the epiphysis. This we can find out from the x-ray.

Syphilis seldom forms sequestra. This we can find out from the x-ray.

When one bone in the body is affected by syphilis other bones are also. This can be found by the x-ray.

Take another disease, e. g., rickets. The x-ray tells us that the zone of ossification is broadened, that the adjacent surfaces of the diaphysis and epiphysis are irregular, that there are areas of little density in the broadened portion of the diaphysis, that there is increased cortical bone on the concave side of the distorted long bones, etc. It does not tell us whether the epiphyseal line is red or yellow, or how the concave side smells, but it does tell us enough so that we should not make one mistake in a hundred in making a diagnosis of rick-

ets. We might then infer that the epiphyseal line is purple because we know that the section of a rachitic bone shows a purple epiphyseal line.

Let us suppose an instance and draw our deductions.

Here is a skiagraph of a tibia, showing a loss of substance in its lower end. This much we can be sure the x-ray says truly, but when we begin to infer what tissue of little density lies in that cavity where the loss of substance has occurred, we begin to tread on dangerous ground. Now we know from pathology that such a loss of substance may be caused by an abscess in the bone or a medullary sarcoma or chondroma or gumma. We examine the x-ray more closely. If it is an abscess it is likely to have a certain amount of new bone formation in its wall. This will make the abscess cavity appear to be surrounded by a dark wall. If the light area is due to a medullary sarcoma, we may see trabecula passing across it here and there, giving it a mottled appearance. If chondroma, it has probably an erosion or a protuberance when seen in the lateral view. If a gumma, probably there are other lesions in other bones.

Perhaps we shall have recourse to the clinical history for the most important evidence. I would no more make a diagnosis on the x-ray alone than I would say pneumonia on the strength of the stethoscopic examination alone. Sometimes I should feel pretty sure in either case, but I should like to hear a cough, or to see the temperature chart and a little rusty sputum before speaking positively.

I have no intention of claiming to make all diagnosis from the x-ray, but it is of great importance. What it does tell us is how the inorganic portion of the bone is affected, and this is a great assistance if our knowledge of pathology can tell us the

way each disease affects the inorganic portion.

4. *The ability to reconstruct a picture of the pathological conditions in the individual case from the inferences deducted from x-ray pictures.* This fourth requisition means a thoro knowledge of all the other three steps. One must understand the distortions which are characteristic of every x-ray picture. For instance, the x-ray picture of a cube may appear like two squares, a larger and a smaller; or like two superimposed trapezoids, varying in shape according to the angle from which the rays come. One must know how these distortions affect the normal x-ray anatomy of the various bones. One must know the pathology of each disease thoroly. Finally, one must reconstruct the cube from the larger and smaller square, the actual bone from the x-ray chart, the kind of disease from the particular way in which the bone is invaded, and the odor, the appearance, and the feeling from knowledge of pathology of the disease itself.

Is this way more difficult than deducing the appearance of the heart from what you hear of its murmurs? Can you not form a mental picture of the appearance of the kidney from your examination of the urine?

Expressed simply, my statement is this: If you know how to interpret it, a good x-ray will tell you much of the condition of the inorganic portion of the bone. Different diseases affect the inorganic portions of the bone in different ways. If you know what these different ways are you may get great help in your diagnosis from the x-rays.

Dr. Bozzali, director of clinical medicine at Turin University, has cured, by means of the x-ray, a supposedly incurable case of leukemia.—*Electrical Review*.

#### American Electro-Medical Society.

The executive council will admit to the program of the next meeting (December 1 and 2) papers on any branch of progressive therapeutics. Papers are expected from Dr. O. Shepard Barnum, Dr. Heber Robarts, Dr. Ivan F. Amilon, Dr. Carl Beck, Dr. J. A. Robison, Dr. H. Preston Pratt, Dr. John E. Gilman, Dr. Stuart Johnstone, Dr. James R. Hawley, Dr. R. H. Lewis, Dr. Sheldon Leavitt, Dr. D. A. Stevens, Dr. H. Perkins Fitzpatrick, Dr. F. A. Leusman and several others.

The meetings will be held in the Masonic Temple, Chicago, commencing at 10 a. m., on Thursday, December 1. This is a convenient time for those who are on their way eastward from the World's Fair formal closing.

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#### The Sayen Tube.

By the kindness of Messrs. Queen & Co., of Philadelphia, we present to our readers colored plates showing the appearances of a high and low x-ray tube. This tube was worked out in the laboratory of Queen & Co. In the low tube the kathode stream is seen distinctly as it passes to the anti-kathode at the center. Rarely in such a tube it is possible to see a portion of the reflection of the stream as it passes from the anti-kathode to the active hemisphere of the glass bulb.

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#### Roentgen Ray Anniversary.

The tenth anniversary of the discovery of x-rays by Röntgen will be celebrated in Berlin, April 30, 1905, when a congress will be held for the purpose of discussing the production and application of the rays. Prof. Röntgen will be present as the guest of honor.

# Electro Therapy.

## Lesson 16. The Fluoroscope.

BY T. PROCTOR HALL.

A considerable number of substances, under the action of x-rays, become fluorescent, giving off visible light. Crystals of calcium tungstate shine brightly, and continue to shine for some time after the exposure. Such a screen is not well adapted for a fluoroscope, for the shadows upon it interfere when there is any motion of the objects examined. Barium platino-cyanid ( $\text{Ba Pt C}_6\text{N}_6$ ) is also strongly fluorescent, but its fluorescence ceases almost immediately when the x-rays no longer reach it. A black card, coated on its inner surface with these crystals, forms the ordinary fluoroscopic screen, which is placed in a black box so as to be viewed in complete darkness.

In using a high tube it is important to protect the screen from the rays that are diffused or reflected from the observer's body or from surrounding objects, which will otherwise obscure the view by spreading a diffused light over the screen. This may be done by making the fluoroscope box of some metal fairly opaque to the rays, or by placing against the screen on the side next the eyes a plate of lead glass.

These and other diffused or scattered rays are the chief difficulty in the use of the fluoroscope. If we try to see a rib, the rays which scatter from all the surrounding parts of the body help to illuminate the screen and obscure the shadow of the rib. Many of these rays may be eliminated by a lead screen placed between the patient and the x-ray tube, with an opening just large enough to illuminate the part to be examined.

The penetration of the rays must be adjusted to suit the parts to be examined. The general rule is to use a tube as low

as will penetrate well the parts examined, when differentiation of tissue is desired. But in looking for opaque foreign bodies a much higher tube is advisable if the diffused rays are well screened off. The tube must in each case be adjusted by trial.

To estimate the depth of a foreign body with reference to bones near it, the limb is turned slightly back and forth about an axis parallel to the screen. The extent and direction of motion of the shadow of the foreign body with reference to the shadows of the bones, or of a lead wire upon the skin, enables a fair estimate to be made of its depth. The shadow of an object between the axis of rotation and the screen moves over a distance proportionate to its distance from the axis. The shadow of an object on the other side of the axis moves in the opposite direction and in the same proportion.

A single view with a fluoroscope thus enables one to locate a needle or a bullet, as to position and depth, while a single radiograph gives no idea of the depth.

If two distinct views are obtainable of, say, a bullet which is to be located, a convenient plan is to mark with a skin pencil an *x* on each side of the limb or part containing it, marking when the end of the pencil is apparently on the bullet, and an *o* on each side similarly with the second view in another direction. These four landmarks are ordinarily a sufficient guide for the surgeon, for he knows that the bullet is at the intersection of the line joining the *o*'s with the line joining the *x*'s.

In examining the motions of the heart, lungs and diaphragm it is better to use a



large flexible fluorescent screen, instead of a fluoroscope, in a dark room. All clothing should be removed from the chest.

The beginner finds it difficult to distinguish between the shadows of museles, scapulæ, etc., and abnormally dark lung shadows. Generally, shadows that are alike on each side are normal. Much information may also be gained by observing the depth, in the way already indicated. Nothing of value can be learned by an unpracticed eye, except in gross lesions, in which this gives a valuable confirmation of other physical signs. But in the hands of an expert this method is one of extreme delicacy.

The physical condition of the observer and especially of his eyes makes a great difference in the delicacy of the fluoroscopic examination. One who is tired, or who has just come out of the bright sunlight, may be unable to see anything clearly. A fresh fluoroscopic screen is also much better than an old one.

#### **Cancer of the Mamma Cured by Roentgen Rays.**

E. Schiff reports a case of inoperable cancer en cuirasse of the left mamma with lenticular metastases of the cutis. The left thorax was invaded by a tumor with large basis and of very solid consistence. The tumor extended from the left sternal margin to the axillary cavity, where it reached the glands and formed a hard bunch. The surface was ulcerated and exuded fetid matter. The lower edge showed ten or twelve small tumors, slightly bleeding. On the patient's back were five similar nodules. Beneath the bunch in the axilla there was a crateriform cavity large enough to admit a pigeon egg. The edges were gangrenous. Both supra and infraclavicular glands were hard and

resistant. After the third sitting the pain decreased considerably, and the purulent secretion diminished. After five months' treatment the writer noticed that excepting some superficial excoriated parts, a flat scar crossed by some enlarged capillary vessels had taken the place of the former tumor. The cutaneous metastases had disappeared and the groups of soft glands in the supra- and infraclavicular regions had greatly decreased and were soft. The general state of the patient had very much improved. The writer then gives a description of the histological appearance of the tissues, showing that the new growth had almost disappeared at the time of examination.—*Bulletin of The Johns Hopkins Hospital.*

#### **The Treatment of X-Ray Burns.**

Mr. H. Lyle, senior surgeon to the Liverpool Hospital for Cancer and Skin Diseases, writes to the *Lancet* that he now believes them to be reasonably amenable to treatment. The method recommended is free application of an ointment composed of plumbi oxidum, one drachm; zinci carbonas, two drachms; glycerinum, one drachm; oleum olivæ, half a drachm; adeps benzoatus, to one ounce.

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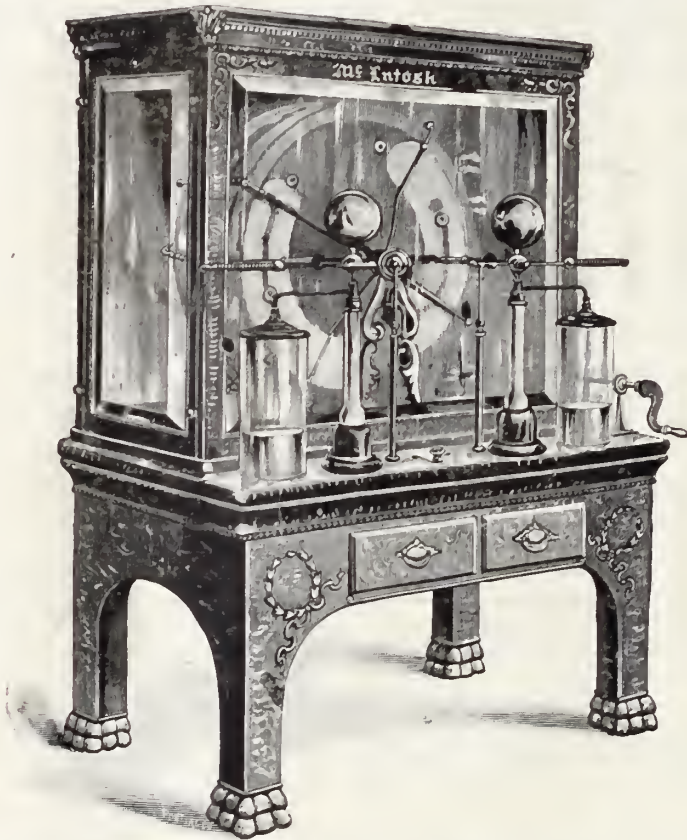
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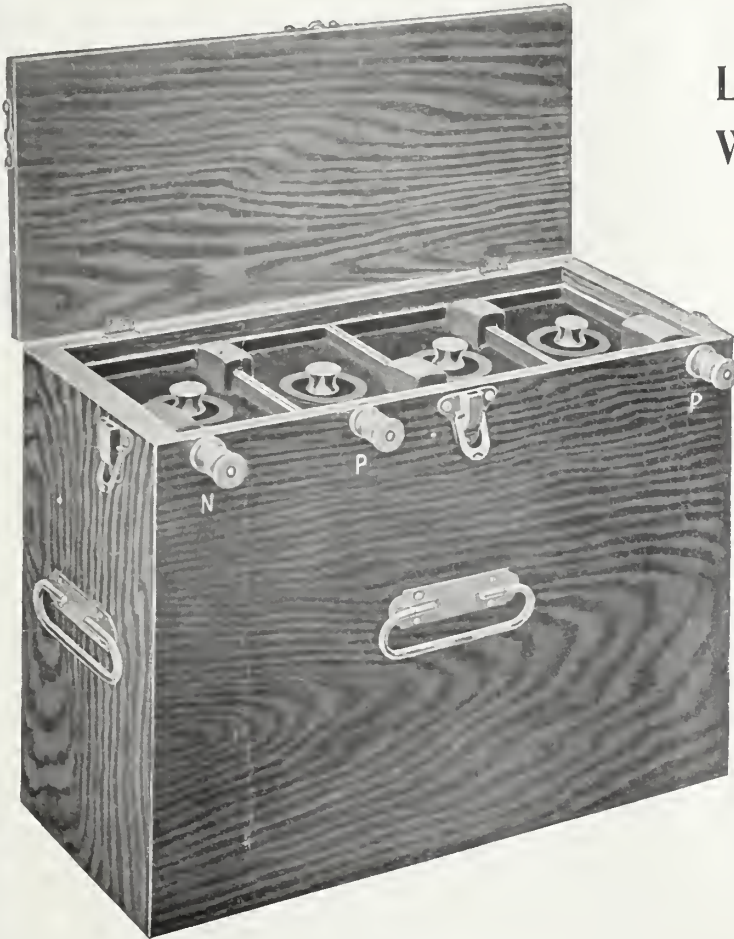
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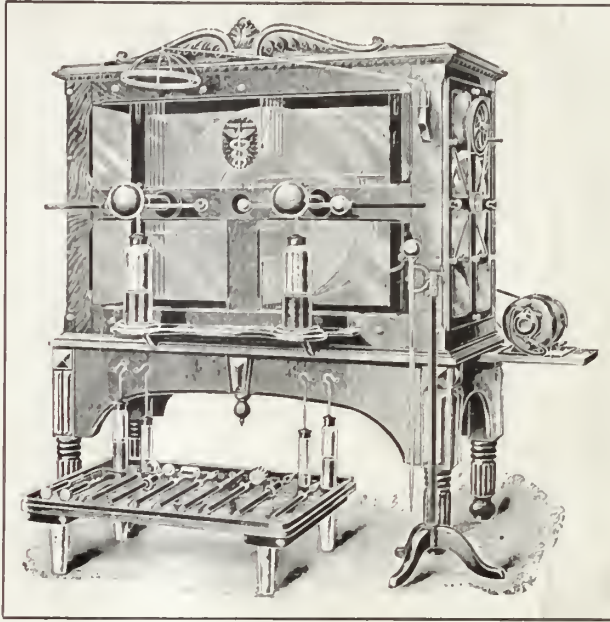
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